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Telephony.

VOLUME VII.
NUMBER 5.

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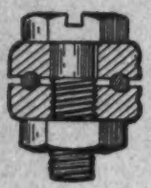

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Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

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LINCOLN'S NEW AUTOMATIC SYSTEM

LINCOLN, Nebraska, enjoys the distinction of having the first large automatically operated telephone exchange west of Chicago, the exchange there having been in operation since March 15. The original plans and the specifications for the Lincoln system contemplated a manually operated exchange; the contract for the construction work had been let to the General Engineering Company, Chicago, and work was well under way before it was decided to depart from the beaten paths of Independent telephony and install an automatically operated exchange system, manufactured by the Automatic Electric Company, Chicago.

It requires no small amount of nerve, of the kind exhibited by the hardy pioneer, for the promoters and financiers of a plant of this size to turn aside from the tried and proven equipment which is known to have brought success to hundreds of Independent telephone installations, and stake their reputations and capital on as radical a departure from accepted exchange methods as in the installation of an automatically operated exchange. Those in charge of affairs at Lincoln, however, have taken every possible precaution to offset the contingencies incident to installing a but recently perfected system, by building all portions of the plant in accordance with the best telephone engineering methods, and without looking too closely to the question of first cost. This is evidenced, in part, by extending the underground system far into the residence districts, leaving as little as possible of the cables and wires exposed to the elements; by building an absolutely fireproof exchange building, even the walls and floors being constructed of the best cinder concrete, supported in the most approved manner, and all woodwork being eliminated, excepting door and window casings; all floors being tiled, except two of the office rooms. All uncertainty as to ground circuits has been removed by the use of complete metallic ground circuits, and the best protection procurable has been used, at both the rack and the subscribers' ends of the circuits.

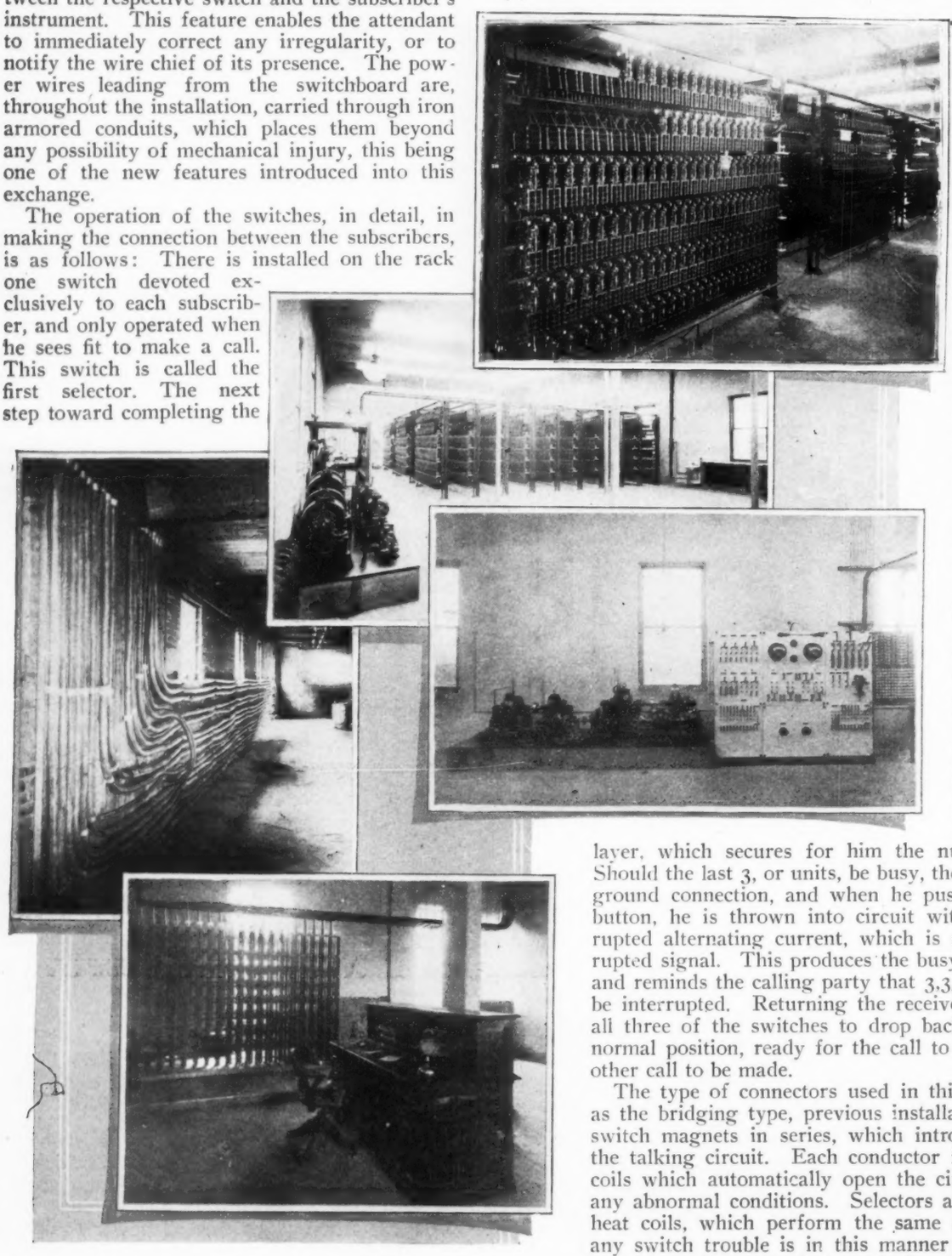
THE CRADLE OF THE AUTOMATIC TELEPHONE IN NEBRASKA.

The exchange building, located on Fourteenth street, between M and N streets, has a frontage of forty-three feet and a depth of 140 feet, and consists of two full stories and high basement. The upper floor is reserved for the power plant and switchboards, and is extremely well lighted, having windows on all sides, in addition to five large skylights, making it possible to inspect all parts of the intricate switchboard with the greatest ease. There are at present installed switches sufficient to accommodate 3,000 subscribers, and floor space has been provided to increase this number to 7,000. The racks containing the switches are divided into groups of 1,000 each, and each 1,000 subdivided into tiers of 100 each. The power board is provided with two alternating motor aquipments, each connected direct to a direct current generator, which furnishes current to charge the storage batteries in the basement. The storage battery equipment consists of two banks each of twenty-six 350-ampere hour cells, which furnish the current for operating the switches, for operating the 20-cycle alternating generator, for the ringing circuit and for the busy signal and howler, all power equipment being in duplicate.

The interrupting machine used by the Automatic Electric Company elsewhere is dispensed with in this installation, as the individual rotary on each selector switch renders it unnecessary. This is one of the many improvements introduced into this installation and not elsewhere installed. The Italian marble switchboard is provided with the necessary ampere meter, voltmeter and overload and underload circuit breakers for charging the storage batteries. At the

right of this power switchboard is the tell-tale board, provided with relays, in connection with miniature incandescent lamps, which become illuminated when any one of the 3,000 switches is, in any manner, rendered inoperative. They also indicate the variation of resistance in the line between the respective switch and the subscriber's instrument. This feature enables the attendant to immediately correct any irregularity, or to notify the wire chief of its presence. The power wires leading from the switchboard are, throughout the installation, carried through iron armored conduits, which places them beyond any possibility of mechanical injury, this being one of the new features introduced into this exchange.

The operation of the switches, in detail, in making the connection between the subscribers, is as follows: There is installed on the rack one switch devoted exclusively to each subscriber, and only operated when he sees fit to make a call. This switch is called the first selector. The next step toward completing the call is the second selector, a switch very similar in appearance, which, in turn, operates a connector. The two latter switches are common to all the subscribers in the exchange. Should a subscriber desire to call another subscriber, whose number may be 3,333, he places his finger in the third hole, number 3, from the bottom, of the circular calling device on the front of his telephone, and pulls the dial down, which revolves on a pivot, and when released, will return to its original position. The first selector switch at the exchange has now stepped up three notches, which has caused its wiping contact brushes to make contact with one of the terminals trunked to the 3,000 group. This brush automatically selects the first contact which is not in use. He is now on the second selector switch in the 3,000 group, and by placing his finger in the third hole on the dial, as before, and pulling it down, this second selector is caused to step up three notches, bringing it in contact with that terminal which is trunked therefrom into the 3,300 board, after having passed automatically over any terminals which may be in use. All connector switches have three banks, of 100 contacts each, ten layers up and ten contacts in each layer, which are multiplied into each group of hundreds. By pulling the dial down again with his finger in the third hole, he is connected with the third layer up, and again pulling down the dial in the same manner, the wiping brush is moved to the third contact in the third layer, which secures for him the number desired, 3,333. Should the last 3, or units, be busy, the contact passes to the ground connection, and when he pushes his calling push-button, he is thrown into circuit with the 20-cycle interrupted alternating current, which is sending out an interrupted signal. This produces the busy buzz in the receiver, and reminds the calling party that 3,333 is busy and cannot be interrupted. Returning the receiver to the hook causes all three of the switches to drop back by gravity to their normal position, ready for the call to be repeated, or some other call to be made.



EQUIPMENT AND APPARATUS IN LINCOLN SYSTEM.

The type of connectors used in this exchange is known as the bridging type, previous installations having had the switch magnets in series, which introduce impedance into the talking circuit. Each conductor is provided with heat coils which automatically open the circuit, in the event of any abnormal conditions. Selectors are provided with two heat coils, which perform the same office. Consequently, any switch trouble is in this manner localized and throws out of service only that particular selector. Each group of 100 is provided with thirteen connectors, which make it possible for a calling party to reach ten on the first 1,000, ten on the second 1,000, or ten on the third 1,000, and thirteen subscribers may call in or out, an efficiency of twenty-six per cent. This can be increased or diminished. Should any particular section of the switchboard become more in use than another, "traffic" can very easily and without expense be provided by increasing the number of connectors,

by transferring the connectors from the less active section, thus giving the same flexibility to the automatic system that the intermediate rack provides for in the manual system. The wire chief's desk, as shown by the accompanying cut, is provided with numerous switches and testing keys, also one first selector, one second selector and one connector. A Western voltmeter bridge and voltmeter is also here located, thus affording the wire chief all the necessary appliances for his duties.

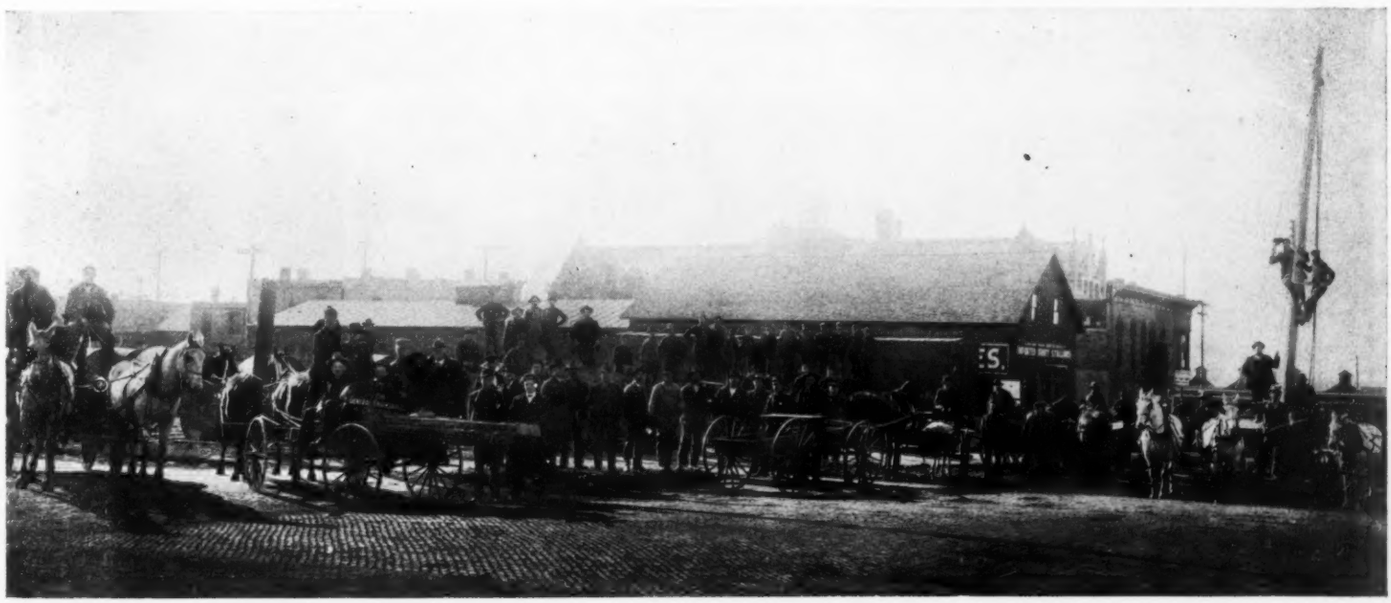
The calling device is an improvement over that used elsewhere, having an additional finger hole, making eleven in all. This extra finger hole is marked "long distance," and by pulling the dial down to the stop once only the subscriber is connected immediately with the toll operator. Another valuable improvement is the rotary device, which is devoted to the 3,200 section of the switchboard, 50 connectors and selectors being reserved for those business houses whose business justifies the installation of more than one telephone in their establishment. Any subscriber having two or three telephones at the same place of business, advertised under one number, may be connected with this device, which enables any calling party to get in on the idle telephone should the other two be in use by clerks receiving orders. The automatic calling device passes on from the first to the second and on to the third, and should that one be busy also the calling party receives the busy signal in the usual manner.

METHOD OF POLE RAISING AT LINCOLN.

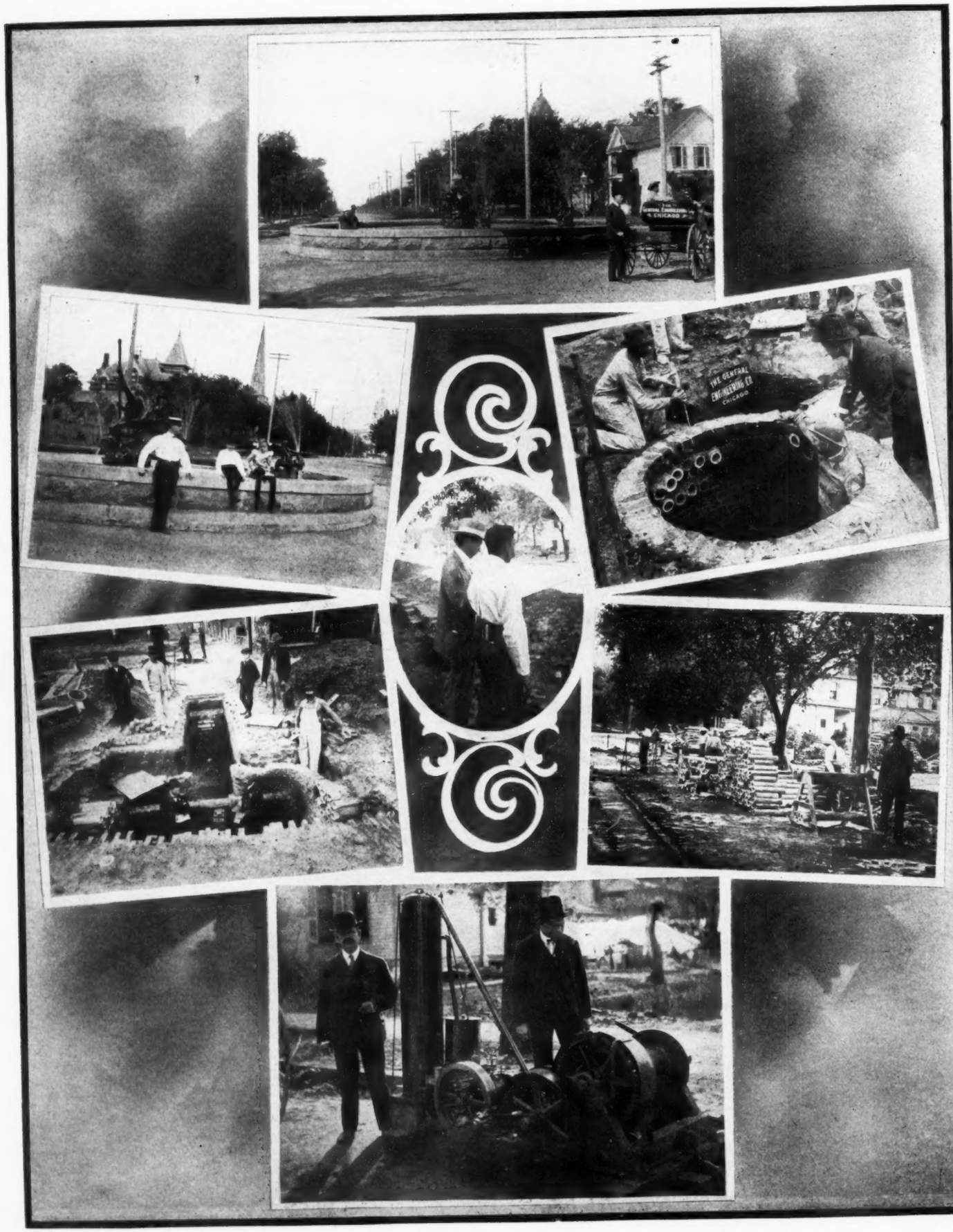
As a means of transmitting fire alarms the Automatic is found very expeditious. Some are disposed to condemn this system on account of the fact that subscribers are inclined to become more or less excited while giving a fire call, thus being unable to operate the dial properly. We find, however, that by using the long-distance finger hole and pulling down once the party calling is placed immediately in connection with the toll operator, who is amply qualified to receive fire calls intelligently. She immediately transmits the call to the several fire stations by special arrangements, whereby these stations are multiplied together. Thus all receive the location of the fire at the same time.

The toll board room is located on the first floor accessible to main entrance, where three booths are located, which provide ample facilities for the convenience of non-subscribers who desire to talk out from the exchange. The toll board is provided with three positions of ten lines each, one position for pre-payment telephones throughout the city, one for farmer lines and the third for out-of-town lines. This board has an ultimate capacity of fifteen positions in order to accommodate the growth of the toll line business.

The information bureau is a unique feature, located in a seperate vestibule where comfortable chairs await those who may choose to loiter while waiting to receive answers from parties whom they have called over the long-distance. This information department promises to be of particular advantage in dispensing its commodity, where observatory time may be had at any moment during the twenty-four



GENERAL ENGINEERING COMPANY'S MEN, BUILDERS OF THE LINCOLN SYSTEM.



MODERN CONSTRUCTION OF THE LINCOLN TELEPHONE COMPANY'S SYSTEM.

hours. Subscribers may telephone their requests to be called at any particular time during the night and thus dispense with their alarm clocks at home. Important events which transpire—lost children, horses strayed or stolen, etc.—may be reported and their recovery facilitated. The location of fires as they may occur, disputes or arguments may easily be settled automatically.

During the installation of additional telephones from time to time subscribers who may call for some number which has not been connected or in cases where telephones have been removed these dead wires are multiplied into this desk and the calling party is immediately informed accordingly. Those subscribers who, from force of habit, mourn the loss of the silvery voice, and who do not consider a telephone message complete without the assistance of the "departing girl," may call up automatically the information clerk and request her to operate the dial for him and gradually taper off from his habit, thus becoming reconciled to the inevitable.

Every possible feature which will enhance the utility of the telephone has thus been provided for and some features which are impossible with the manual system are easily taken care of.

A new and popular feature introduced into this installation is that known as the individual rotary, the arrangement being such that, should a large firm require two or more telephones in one location, the selector at the exchange will, if it finds one of the telephones in use, pass to the second or third until it connects with a telephone not in use. The subscriber can thus be sure that any person calling his number will be connected to one of his instruments, if all are not in use.

The Automatic Electric Company has spared nothing to make this installation a model of its kind and size, and it represents, in its every detail, the most advanced practices in automatic telephony. The company is to be congratulated upon the results achieved.

The first, or main, floor of the exchange building is devoted to the cross-connecting rack, public booths, toll line operators and the general offices of the company. The cross-connecting rack is of the well-known Cook type, and connection is made with the switchboard above by means of silk and cotton covered switchboard cable.

The basement of the building is occupied by the storage battery plant, heating plant, storerooms and repair rooms. The cables from the underground system enter this basement through a well-lighted tunnel, and reach the distributing rack on the floor above through potheads at the floor line. Cables from the four main trunk lines of the underground conduit system, enter this tunnel from the main manhole, which is 18x12 feet inside.

American Stone Conduit Company conduit, laid in concrete, is used throughout the underground system, and sufficient duct capacity has been provided for 10,000 subscribers. This is probably the first cable system of considerable size in which the customary wiped lead joint has been eliminated, in splicing, the brass splicing sleeve, made by the New Haven Novelty Machine Company, having been used exclusively, and the Novelty potheads, made by the same company, have also been used throughout.

A feature of the installation of the underground system has been the drawing in of the cables by means of a portable power wince, operated by a gasoline engine, the whole being self-contained and mounted on trucks. An illustration of the device is shown herewith. This is one of the several labor and time-saving devices employed by the General Engineering Company in this installation, another being an improved portable pole derrick of its design, with which 104 poles have been placed in an eight-hour working day, with six men. The aerial distribution comprises about fifty miles of pole line, employing 2,000 Idaho poles from forty to fifty-five feet in height. Seventy-five miles of aerial cable, and 600 miles of No. 12 B. B. iron wire are items entering into the equipment. The underground cable aggregates 65,000 lineal feet, largely 250-pair.

All of the construction material for this installation (about 250 carloads) was purchased through the firm of George W. Conover & Company, purchasing agents for Independent telephone companies.

The Lincoln Telephone Company is composed entirely of representative local business men, all of the company's securities having been disposed of at home. The president, Col. C. J. Bills, and Frank L. Bills, who have been active in promoting and financing this plant, have been prominently identified with the Independent telephone movement for several years, having promoted and put in successful operation fifteen or twenty well-known Independent exchanges and many hundred miles of toll lines. Their names are not new to the Independent telephone fraternity. They have associated with them in the Lincoln enterprise, Judge A. W. Fields, F. H. Woods, George J. Woods and Mark Woods. F. G. Bills is secretary of the company; Benton Maret, general manager, and T. H. Ewing, superintendent. It is due to the enterprise and lively interest exhibited by the individual members of the board of directors that the city of Lincoln will have its demand for efficient telephone service supplied through the medium of a system that is thoroughly first-class and up-to-date in every particular. This company has builded for the future, and the people of Lincoln have shown their appreciation by responding so generously to the call for subscribers that before the exchange became operative it was found necessary to greatly increase the cable capacity and to extend the service into territory which the company had not expected to reach in the near future. The company is already preparing to add to the present exchange capacity of 3,000 switches.

No small proportion of the credit for the general excellence of this installation is due to the General Engineering Company, which has acted in the dual capacity of contractors and consulting engineers in the Lincoln Telephone Company. The company has stood for the best possible construction in every detail, for first-class material, and for ample reserve capacity throughout. The gentlemen composing this company are of many years' experience as engineers and in the telephone field, though they have been associated together but a comparatively short time, and it is notable that the construction of two of the most important Independent exchanges undertaken during the past year should have been placed in their charge, viz., Lincoln, Nebraska, and Sioux City, Iowa. The enviable record they have made for themselves in Lincoln, places them in the front rank of telephone engineers.

The officers of the company are: E. W. Hammer, president; H. J. Minhinnick, secretary. Their persistent efforts in the direction of high-class construction have received the hearty co-operation of the directors of the Lincoln Telephone Company, and, as a result, that company has a telephone system of which it may well be proud, one that is a credit to their city, that is receiving the enthusiastic support of the citizens, and that will prove a source of profit to their many local investors.

Toll lines radiating in all directions from Lincoln will be built without delay, a special organization having already been effected to energetically push this feature of the extension work.

The public demanded relief from the Bell octopus, and the Independent movement was the outcome—an enterprise the growth of which in its myriad branches, has attained such a vastness as to become the marvel of millions, the wonder of the world of industry. It satisfies a crying need of a monopoly-oppressed nation as nothing else has in modern times, and its mission has only fairly begun.

Digest of Telephone Literature

SAMUEL G. McMEEN;

Telephones in Railway Stations.—Canadian Engineer, April.

FINANCIAL AND ECONOMIC.

An editorial on the recent action of the (Canadian) Board of Railway Commissioners concerning the privilege of Independent telephone companies to place their instruments in railway depots. Notice is taken of the action of the Grand Trunk and other railways in providing their own telephone service over their telegraph systems.

The Municipal Telephone.—WEBB.—*London Electrical Times, March 24.*

A criticism of municipal telephones of which the writer claims that his treatment of the subject is dispassionate and unbiased. The matter treated relates wholly to conditions in Great Britain. The author is Herbert Laws Webb, long connected with American Bell circles in the United States, now a consulting engineer in Westminster.

Independent Telephony.—Canadian Engineer, April.

An editorial of considerable length, commenting upon Toronto Bell and Independent conditions and two franchises which are being sought by the latter interests in that city. A resumé is given of evidence as to the value of Independent service, from the user's point of view, collected in the United States by circular. The summary indicates general belief that the existence of Independent properties has worked to the advantage of the public. The pertinent statements are made concerning the Canadian situation in general: that the present telephone service is altogether inadequate to the needs of the Dominion; that there is a demand on the part of the people for more telephones; that competition is the one means of supplying the peoples' need.

Gambling by Telephone.

The daily press of Chicago has been filled for some weeks with reports of a controversy between the city of Chicago and the Chicago Telephone Company with reference to the attitude of the latter toward pool rooms and handbook operators as telephone subscribers. It is interesting to speculate whether the settlement of this question may introduce a new feature into the relations of operating companies to their patrons.

Modern Methods of Telephone Manufacture.—WEGNER.—*Sound Waves, April.*

A general article upon some phases of the matter indicated by the title. The writer reports that $100,000,000 are invested and 100,000 persons are employed in telephone manufacture; he deals with the disadvantages of wrong methods and the advantages of right methods, and indicates a very hopeful view of the future of the industry.

Comparison of Independent and Bell Telephone Service.—OVERLY.—*Finance, April 9.*

A very fair summing up of past and present conditions, pointing out some changes which have occurred and some conditions that lead the writer to believe that the popular and successful Independent service of the present will grow because of its increase in both qualities.

Government and Telephones.—London Electrical Review, April 8.

A further editorial upon the condition of the governmental telephone situation in Great Britain. The matter presented is largely local in interest. A financial illustration given by Lord Stanley in the House of Commons quotes the average capital cost of the London system as approximately $500 per subscriber and the average gross revenue approximately $40 per subscriber. Editorial comment is to the effect that the income is insufficient, relative to the investment. Further comment states that the cost of the postoffice service is twice the gross income.

European Telephone Statistics.—Electrical Review, April 16.

An editorial on conditions in Sweden, Denmark, Norway, Germany and Hungary. The growth of the telegraph traffic in these countries in the last ten years has been small while that of the telephone has been large, being from 10 per cent to 100 per cent in the various countries. The growth of telephone traffic is assigned as the reason for the very small growth of telegraph business.

Development Ratio.—London Electrical Times, March 17.

In a note concerning the accounts of the state's telephone department for 1903 it is stated that Guernsey has the cheapest telephone service of any place in the United Kingdom and also that the proportion of instruments to the population is the highest. The telephone proportion is given as one telephone to about thirty-three souls. The average revenue for Guernsey for 1903 is given at £3 6s. 9½d. per instrument ($16.00).

The Telephone Situation.—London Electrical Review.—April 1.

An editorial commenting upon a statement of the postmaster general to the House of Commons upon that subject. The financial details are given, together with comment upon the telephone accomplishments and possibilities in the United Kingdom. It is noted that long-distance communication is not fully developed as an extensive habit but that such a development is under way. One of the reasons for this limitation is the existence of a satisfactory and inexpensive telegraph service.

Manual vs. Automatic Telephone Exchanges.—KNOWLTON.—*American Electrician, April.*

EQUIPMENT.

Comment of a general character upon the advantages and disadvantages of both systems. It is undertaken to point out the requirements which the automatic system must meet if it is to take and hold a firm position in telephone practice. The ingenuity of design and excellence of construction of some of the late automatic apparatus are complimented. The author does not believe too great value should be placed on the freedom from labor troubles accomplished by eleminating human operators. The automatic character of the central office equipment is commented upon as acting to burden the subscriber with certain extra labor, so that in a sense the manual system with the signal mechanisms of to-day is to the subscriber more automatic than the automatic, and under certain circumstances of emergency the manual system might prove the more satisfactory to the user. The greater complication of substation mechanism, in the writer's judgment, is a point against the automatic system. To reduce substation annual costs has been the result of the refinement of the manual system; to complicate the substation mechanism for automatic reasons will raise this cost; the character of certain automatic systems also raises this cost by using three wires to each station. The secrecy of the present manual systems is compared favorably with automatic systems. On the whole, the writer is inclined to condemn automatic systems as they stand.

Cordless Switchboards.—HIGGINS.—*Telephone Journal, April 9.*

A short article on the advantages of switchboards in which connections are made by hand but without the use of flexible cords, and a few details with two cuts of one such switchboard lately designed for private exchange purposes in Los Angeles, California.

Receiver Investigations.—LATTIG AND GOODRUM.—*Telephone Journal, April 9.*

A report upon an attempt to analyze the operation of a

hot wire telephone receiver. Several interesting features were noted in the experiments, which were not carried, however, to a definite conclusion on either of the lines attempted.

Electrostatic Capacity.—ABBOTT.—*Telephone Journal, April 9.*

An installment of a series entitled "Impedance and Retardation." Electrostatic capacity in general, specific inductive capacities of materials and the condenser are treated.

Central Telephone Exchange, Moscow, Russia.—*L'Electricien, December 5, 1903.*

A short note relative to details of dimension and cost, based on an article in the Rous, Kiia Viedimosti. The advantages of automatic lamp signals are subject of comment in the manner usual when such equipment is first established in any region. The reduction of expense per station per annum, an improvement of the service and a general simplification of operation are prophesied as a result of the change in equipment.

Circuits and Operation, Common Battery Branch Exchanges.—SPROUL.—*Telephone Journal, April 2.*

A description with drawings. The latter illustrate the cord circuit, local and trunk line circuits and the substation. The system is of that form in which a connection between two subscribers' local to a branch exchange derives current from common bus-bars within the local exchange while a connection between a branch exchange station and the central office derives current from the latter. The character of the line and cord circuits is such that the selection of a source of current in the one case or the other is automatic through the medium of a relay in each cord circuit. In the main the article seems to describe a system extensively used in the larger cities.

Exploring Appliance for Accumulators.—COAR.—*Telephone Magazine, March.*

A short article describing a simple homemade mounting of an incandescent lamp, so that the conditions inside a storage battery can be learned by lighting up the spaces between and about the plates. The writer gives credit to Sauter for the conception of the idea.

The Telephone.—TAYLOR.—*Sound Waves, April.*

The fourth installment of a serial of a general scope. This section treats of the structural details of granular carbon transmitters and induction coils. The mechanical and electrical dimensions of the latter are treated at some length and the subject is to be continued in other issues.

The Telephone Substation.—ABBOTT.—*Electrical World and Engineer, March.*

Three installments, the last completing the series. They treat the details of this important phase of telephone engineering and should serve as a valuable source of information for those in need of the dimensions of transmitters, receivers and particularly of induction coils. On the latter a great amount of tabulated information is given. The third installment of the series contains columns of data for coil winding, in which are treated for single and double cotton and silk insulation, the resistance per cubic inch, turns per linear inch (given in this instance also in the form of the reciprocal), feet per cubic inch, diameter over insulation and turns per square inch, in connection with a table giving also the approximate resistance per square inch of cross section of winding space. This matter should prove of value to all those having to do with coil windings.

A Novel Switchboard Cleaner.—PEAVEY.—*Telephone Journal, March 19.*

A note upon a portable device consisting of an electric motor driving a small blower to furnish air blast through a hose with a suitable nozzle for blowing dust out of switchboard spring jacks. The motor shaft carries a buff for polishing purposes. The article contains a general discussion of other methods of cleaning spring jacks but concludes that the air-blast method is the more satisfactory.

Portable Storage Battery in the Small Exchange,—MILLER.—*Telephone Journal, Mar. 19.*

A note with a circuit showing a means of driving a pole changer and supplying several battery sets with current from a single portable storage cell; in this case of 40-ampere hours 'capacity.

Street Corner Telephones.—LONG.—*Telephone Journal, April 2.*

In Bridgeport, Connecticut, telephones are installed on street corners, being inclosed from the weather in iron boxes similar to fire alarm and police patrol mechanisms. In connection with automatic coin-collecting devices and a directory, these equipments are reported upon as filling a public need.

An Automatic Pole Changer Starter.—BUNDISMAN.—*Telephone Journal, Mar. 26.*

A note with a drawing describing an arrangement of simple pieces of apparatus to the result that the ringing of the night bell in a small exchange will automatically start the pole changer, which is ordinarily shut down in the evening after the traffic becomes light. This accomplishes the result of saving an unnecessary drain upon the primary battery which drives the pole changer, a small amount of wear of the device itself and the avoidance of the annoyance of using a hand generator at night if the pole changer be not running.

Methods of Signaling and Operating.—MILLER AND WINSTON.—*Electrical World and Engineer, March 26.*

The sixth and concluding article of a series of such methods in telephone exchanges. This installment treats of methods of operating trunks between toll and local switchboards. As has been true of the previous articles of the series, the circuits and methods are clearly described and important features illustrated, and in a degree, the relative advantages of the different methods weighed and compared. The methods described in this installment are those used in the systems of the licensees of the Bell company.

Auxiliary Telephone Circuits.—COAR.—*Telephone Journal, April 16.*

An illustrated description of arrangements for party line, extension line and farmer line conditions which arise in practice by reason of special conditions requiring to be met. The methods shown are good and are clearly covered.

Wireless Telephony.—GRADENWITZ.—*Telephone Journal, April 16.*

Ruhmer's method of transmitting speech by means of light together with details of the speaking arc and of the early photophone contributions of Prof. Ruhmer's apparatus, are described, giving interesting and valuable data with reference to distance and success.

Rapid Cable Testing.—DOBBS.—*Telephone Magazine, March.*

An article of fair length on short methods of testing cables for the identity of conductors and for insulation.

LINES AND LINE CONSTRUCTION.

Short methods of testing are outlined and means not involving the use of the more highly organized devices are set down. The sensitiveness of the telephone receiver is pointed out as making it an excellent substitute for a galvanometer; an interrupted direct current is advocated as better than an alternating current or a non-interrupted direct current if the telephone receiver is so used.

Cable Terminals.—DOMMERQUE.—*American Electrician, April.*

One of the articles of a series. A discussion of the kinds of devices used to terminate aerial and underground cables, and some notes on the economies of multiple destribution of conductors. Details are given of cable boxes, and methods of leading in cables and bridle wires are described. Details of pole fittings, including pole platforms, distributing rings and hooded terminals are provided.

Duplex Telephoning.—*Sound Waves, April.*

A note on the great need of a method of accomplishing this result touching upon the present possibility of deriving phantom circuits from actual circuits. Some of the disadvantages of phantom circuit working are touched upon

together with a note as to some present efforts to avoid these difficulties.

Protection of Telephone Lines against Street Railway Potentials.—*Elek. Zeitung, Mar. 31.*

A note on a controversy between the city of Mannheim and the Government Post Office of Germany upon the question of the expense of erecting and maintaining guard wires over street railway trolley circuits. The result to date is that the city must bear the expense.

Two Methods of Giving Toll Service in Connection with Automatic Exchanges.—WINSTON.—*Western Electrician, March 26.*

OPERATING.

A description of methods used at Dayton, Ohio, and Grand Rapids, Michigan. In the latter exchange the subscribers' lines pass through spring jacks in a manual switchboard section before going to the central office equipment proper. The recording and toll line positions are also manual. The operation of recording and the subsequent steps of the toll connections are quite similar to those of the manual system. In Dayton, the same principle exists, the main difference being in the methods of calling the operator and in guarding the subscriber's line against being held up. In Dayton, there is as yet no switching section.

Improvement in Telephone Service.—WILDER.—*Sound Waves, April.*

A series of practical notes, principally upon operating methods but with several pertinent items of comment on equipment and construction. A number of very general and hurtful practices are cited.

Telephone Engineering.—KELSEY.—*Electrical Review, April 9.*

GENERAL TELEPHONE ENGINEERING.

A long article, illustrated, apparently the first of a series, to be continued under the title given. This first article deals with the series grounded system, treating the details with considerable thoroughness to and through series multiple switchboards. The details of busy test on such a switchboard are treated, together with the conditions under which a false test might be found. Reasons are given why a grounded system came to be an unsatisfactory one, and some of the methods of partially avoiding the annoyances are treated.

Telephone Engineering.—KELSEY.—*Electrical Review, April 16.*

The second installment of the same series treats of systems of trunking between offices and the exchange. The mechanisms of series grounded ring-down trunks are described and illustrated. The advantages of one-way call-wire trunks are pointed out, as are also the reasons for the various advantages and disadvantages.

The Telephone Receiver for Measurements.—HO.—*Electrical World and Engineer, Apr. 16.*

A letter to the editors recommending the use of the telephone receiver with a differential winding as being much superior to the use of the simple receiver in the Wheatstone bridge circuit.

Impedance and Retardation.—ABBOTT.—*Telephone Journal, March 19.*

One of a series of articles. The author gives diagrams and a mathematical explanation of the relations of resistance, impedance, reactance, etc. The series is continued.

Telephone Exchange Engineering.—MANSON, LIBBY & SIMPSON.—*Telephone Journal April 2 and 16.*

The sixteenth article of a series under the title given. This article is concerning the details of cutting, forming and placing the cables of the multiple switchboard and is a continuation of a general division of the series under the title, "Switchboard Cable and Cabling." Excellent drawings illustrate the article and the technical terms are well defined. The methods of arriving at the dimensions of the cables in the various runs are given in detail together with the reasons for the procedure in each case. Details of the color scheme for 63-wire cable and the knots, movements, tools and convenience in forming and soldering in cables are treated in a masterly way.

Simultaneous Telephone and Telegraph Equipment.—STANTON.—*Electrical World and Engineer, April 2.*

A noteworthy article upon an important feature of operation. The various practical methods of adding telegraphic equipment to an existing telephone line, from the simplest to the broadest, are described and in most cases illustrated by diagrams. Illustrations of central office equipment, interior and exterior views of houses, and maps of toll line distribution accompany the article. Particular attention is given to an explanation of the reasons why a combination of telegraphy and telephony upon the same wires is possible. The difficulties of maintaining the usual signaling conditions after the application of the telegraphic mechanisms are treated and some of the escapes from embarrassment are touched upon.

Some Aids in the Maintenance of Common Battery Central Offices.—O'BRIEN.—*American Electrician, April.*

Line insulation should be kept high. Insulation tests once per day are commended. Cord troubles noted as a great cause of annoyance and expense. Improper use of plugs by operators is assigned as a cause of much of the cord difficulty ordinarily found. Supervisory relay adjustment is charged with much of the supervisory signal trouble; daily test and adjustment are recommended. A circuit is given for a testing set for use with cord circuits. It appears that the circuits for which the set is designed are those generally found in the Bell company's larger exchanges. This is also true of the circuit illustrated for "plugging-up" and test purposes. This circuit and its relation to the wire chief's desk and the clearing of troubles, are described at some length and in a useful manner.

Optical Telephony.—*Revue Pratique de l'Electricite, Feb. 5.*

A description with illustrations of Ruhmer's method of speech transmission by means of the speaking arc and selenium cell. The details are those which are familiar to readers through the medium of articles already frequently published.

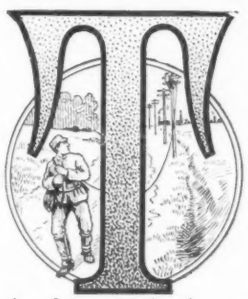
WILL ORGANIZE FOR PROTECTION.

Wire-using corporations in Western Pennsylvania will likely bind themselves together into an association for mutual protection against thieves. So numerous have depredations become that the companies have arrived at the conclusion that some stringent action is necessary. To further this idea a meeting was held in the Western Union Telegraph Company offices in Pittsburg to take the initial steps to organize the association. The companies represented were the Western Union and Postal Telegraph Companies, Central District & Printing Telegraph Company, Pittsburg & Allegheny Telephone Company, Philadelphia Company and the Washington & Canonsburg Street Railway Company. The latter company complains that it has suffered heavy loss in the past year from thieves who steal the wire, and all of the others have stories of robberies along their lines. The purpose of the association is to establish a fund with which to employ detectives to run down the thieves. No definite action was taken at the meeting, but as all of the above companies are said to be in favor of the plan there seems little doubt that the association will be formed in the course of a few weeks.

The Medill Telephone Company in stringing its wire over the Santa Fe railroad near Memphis, Missouri, one day recently, dropped a wire across the telegraph wire, one end of which was connected with the ground. The workmen then went to dinner, and the consequence was that all trains were side-tracked waiting for orders. It is said that a damage suit will be instituted against the telephone company.

Measured Telephone Service

HAROLD D. STROUD



THERE is little doubt that of all the important branches of human effort which have characterized America and Americans as the most progressive of nations and workers, there is no other line of endeavor that has shown such marvelous strides as has the telephone business. It is a business with only about twenty-eight years to its credit, or, more properly, it is that many years since the first public demonstration of the telephone in the form of a toy was made.

As a benefit to the masses, this incomparable gift of science has only begun to be seriously regarded within the last twelve years. It is true that there were telephones before that time, but in numbers and at rentals which made them expensive luxuries, not within the reach of the average small merchant or wage earner.

The person who, even fifteen years ago, would have predicted the present development of the telephone, in its construction and numbers, would have been regarded as a visionary being, whose word was not to be seriously taken. The person who to-day would predict that in the near future telephones would be furnished as a part and parcel of every home or shop, whether occupied by rich or poor, might be thought to be "stretching it" a point or two. Yet there are those who, looking at it from a serious point of view, draw a comparison between the telephone and the gas business, and recall the fact that it was not long ago when the gas companies could count their consumers in an average city square on their fingers. To-day when a house is built its architect never fails to specify that gas pipes shall be placed between the walls, so that all that the person who shall occupy the house is required to do is to order in the meter and he has his gas, and pays for it by the thousand feet. If he wastes it he is the loser and the company the gainer.

With the old way of selling gas before meters were known, or after their invention until the gas companies came to realize the advantages of their use, a consumer could have a gas connection, and the company charged by the burner at a certain price per month. The company had no control over the amount of gas used by the consumers, and in order to be on the safe side they were compelled to put the price per burner at a high figure. With the introduction of meters many people who could not before afford gas found that by economy in its use they could then afford it, and now no house in any large city is without gas for cooking or illuminating.

One might ask, What this has to do with telephones? It is to show that while the telephone is supplied as was the gas in times past, a comparatively few enjoy its benefits, because the companies must hold the rental price high enough to keep on the safe side of the ledger, due to the fact that where a telephone is installed for a fixed price per year or month, in payment for the privilege of unlimited use, the company has no control over the amount of service it may have to deal out. It must serve all who call, and does not have the means of knowing whether this service is being given to those who pay the telephone bill or outsiders. The lessee has no natural motive in reducing the work of the company and uses the service as the people used to use gas, the waste being the company's loss, not theirs.

These subscribers rarely stop to realize that they are doing almost as great an injustice to themselves as to the company. They do not seem to think that when their line is in use by others, this important entrance is closed to those who wish to call them, nor do they figure that in the long run they are paying for the service given the deadheads, because the company must receive enough revenue from its telephones to meet expenses with a reasonable profit, and a large item of expense is the cost of handling the traffic, regardless of who creates it. He does not think that if cheaper service could be given more people would have the telephone, and therefore it would give him more places to call, thereby increasing the value of his service.

It would seem unjust to charge one person who used 100 feet of gas as much as one who used 10,000, yet if we compare again the gas service with the telephone service as it is generally sold, we are at a loss to see in any other light than as an injustice the plan of selling unlimited service. The injustice has been realized by some of the older companies in the business, and in some instances where, a few years ago, we had to pay $175 per year or go without the telephone, we now can have one for five cents per day because each user pays for his service in proportion to the amount he uses—the five cents per day being one call which each telephone must make each day as a minimum to cover the actual investment of the telephone company in wire and equipment.

On this basis the person who makes four calls pays for that number, while the one who averages only one call per day pays for just what he uses, and if the neighbors wish to make calls they pay their five cents, which often helps the small user who averages less than one call per day to meet his guarantee. This service is attractive to many people who use little outgoing service, from the fact that they can be reached by others. The company therefore gains five cents from some other telephone, because this party in having the telephone was the indirect means of causing that call to be made.

Many people who have a busy unlimited telephone find the nickel service of great value as an additional or auxiliary service. They use the other line for out-calls and receive calls on the nickel telephone. The former they keep for private use and the latter is incidentally for outsiders, who, as a rule, make enough use of it to cover the guarantee many times over.

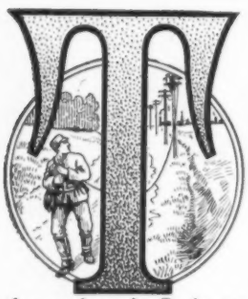
The growth of the telephone business, where this class of service has been introduced, has been so extensive that to predict that the time is near when the telephone will be found in every house, as is the gas meter, requires no great stretch of imagination.

NEW USE FOR THE TELEPHONE.

To apply for a position by telephone when you are out of work is one of the latest manifestations of the universal convenience of long-distance talking. No need now to advise the impecunious young man to borrow $25—of somebody else—for a new suit, hat and gloves in order that he may give out the impression of not being poor. The man at the telephone will listen only to the quality of his utterance and will not be affected by the color of the tie the youth has on. The net saving, therefore, of getting a job over the wire, supposing that the young man has to call up fifty different business men, is $20—a tidy little sum toward staving off the assignment-of-wages man. Great is modern economy.—*Boston Transcript.*

Texas And Telephones

J. J. NATE



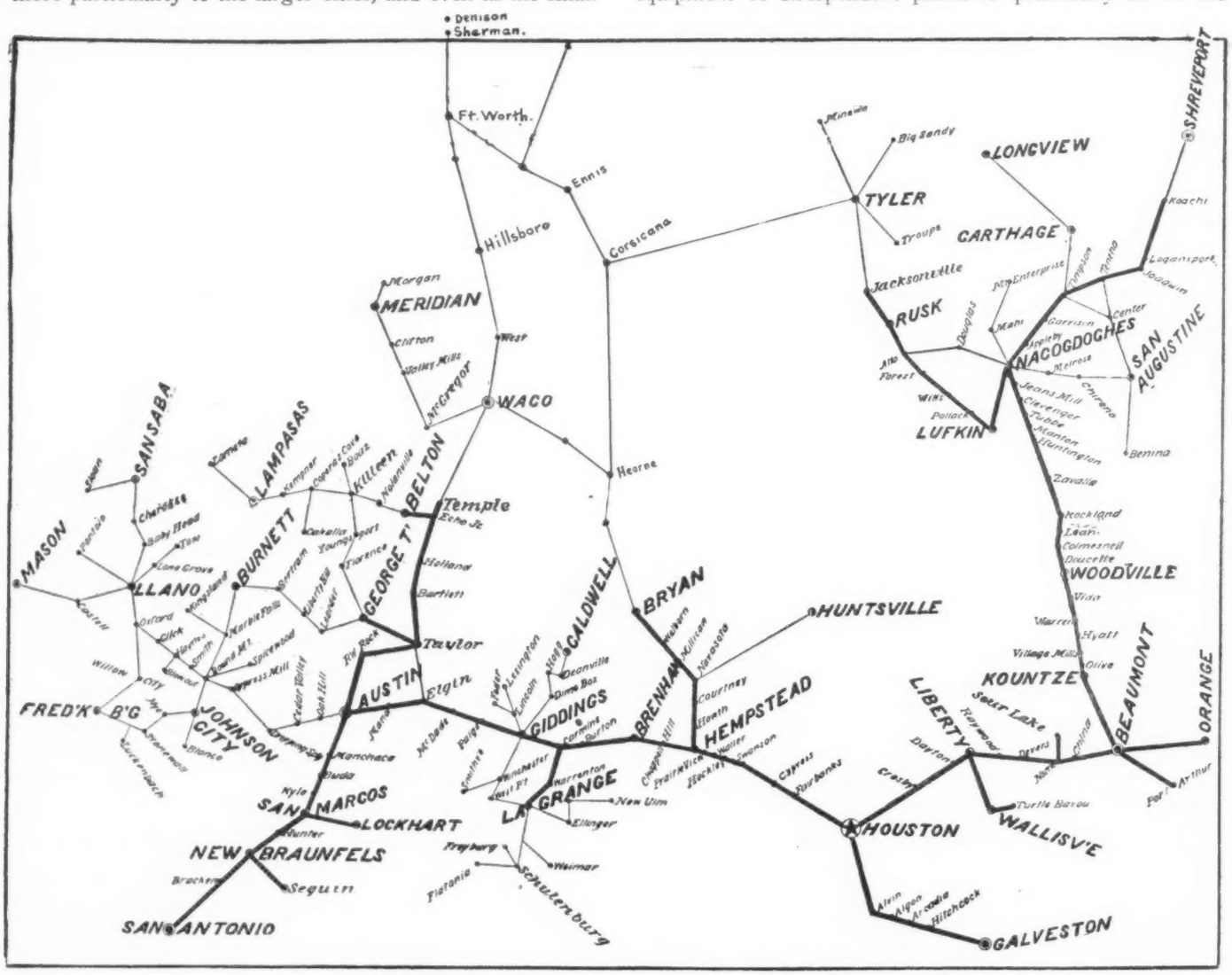
TEXAS and its opportunities for the investment of capital in the Independent telephone field, the work already accomplished, the territory covered, and competition with the Bell company as it exists to-day, presents a most interesting problem in the Lone Star state.

Local capital finds such a ready outlet that the people of Texas have been somewhat slow in interesting themselves in Independent telephone properties. This refers more particularly to the larger cities, and even in the smaller towns, plants are usually owned by a limited number of individuals. Ten years ago there were very few telephones in operation in the state, outside of the principal cities. To-day there are tens of thousands of telephones in operation and not more than a dozen cities having a population of 1,000 or more which cannot boast of a local telephone plant. Toll line communication was practically confined to the larger cities. To-day one may talk very generally between all towns and cities. This condition and the wonderful success of the Independent telephone movement in Texas is beginning to interest new capital, and it needs at this time only aggressive and honest work, well backed financially, to bring Texas into the field as one of our strongest Independent states.

At the present writing, the opposing forces are of nearly equal strength, the Independent companies furnishing a local service in the majority of towns and cities far superior to that of the Southwestern Bell company.

Eastern capital is responsible for the construction and equipment of Independent plants in practically all of the large cities of Texas. Waco may be cited as an exception, and to some extent Texarkana, and among some of the other properties not controlled in the east a limited number of local operators hold a majority of the stock.

Perhaps in no other state in the Union would this condition be possible if it were not for the fact that money in Texas has heretofore found a ready outlet locally through



COMMERCIAL TELEPHONE COMPANY'S TEXAS LINES.

other channels. Just at this time, conditions are apropos to interesting home capital, and if the eastern representatives who are interested in these properties will go into the state and affiliate with the financial interests of that commonwealth, Independent telephony has before it a magnificent future. Conditions are favorable, and many obstacles which have been encountered in other states are not in the way in this territory.

There is a wonderful field for profitable toll line construction, and in no state in the Union do I find such a generous use of toll lines with proportionally increased receipts. The cost of these lines through Texas approaches the minimum for A1 construction, because of the fact that the state law admits of the condemnation, if necessary, for a pole line along the railroad right of ways on a payment of five dollars per mile, with this mileage paid but once. It will be readily seen that not only through this condition are these lines most direct, but tree trimming is practically avoided; admitting, furthermore, the possibility of entering every city, town and village, with the establishment at least of toll stations, even in towns where the Southwestern Bell company is operating exchanges.

It will be seen from the accompanying map of toll lines owned by the Independent people and operated by the Commercial and Lone Star long distance companies, that all of the principal cities south of Waco are reached by Independent lines, fifty per cent of which are copper. These circuits are all metallic and are in use for composite service. The rentals for telegraph service is based upon a certain percentage of the cost of construction per mile for the number of miles used. The telegraph service is a thorough service, and the telephone service is secured from point to point at distances averaging perhaps fifty miles on calls, and is made a through service in very quick time. There are also through lines used for telephone service alone. The receipts at San Antonio, Waco, Houston, Beaumont, Orange, Taylor and other cities amount to several thousand dollars per month. Toll rates are fair and the use of the line is really marvelous.

To complete the chain from Waco to the north, lines are in contemplation from Bryan to Waco, to Tyler and through to Fort Worth; from Fort Worth north to Sherman and Dennison, connecting with the magnificent system of Independent toll lines now in use throughout the Indian Territory, Arkansas, Nebraska and Kansas, thus furnishing a through service from St. Louis and Kansas City into the very heart of Texas.

East from Sherman to Paris and Texarkana, a modern line is being constructed, which will bring into the field Shreveport, Fort Smith, Little Rock, Memphis and other points to the east.

In the western portion of the state, radiating from Brownwood, we have another system of perhaps six hundred miles of toll lines of very fair construction. It is in the further development of the uncovered territory and the rebuilding of the earlier lines that capital will find an outlet, and financial returns from these investments will be found more than satisfactory.

The recent installation of an Independent exchange at Fort Worth makes a toll line combination such as I have described far reaching indeed. It means an Independent plant at Dallas, which has, up to the present time, succeeded in keeping out an Independent exchange, but with such a combination, and Fort Worth its close rival, so closely in touch with the entire state over Independent lines, there can be only one result—the business men of Dallas, sooner or later, will insist on competition, if for no other reason than the fact that much business will be diverted to Fort Worth, a large portion of which more properly belongs to Dallas. Another point to be considered is the fact that Dallas and Galveston are the only two cities in Texas not supplied with an Independent plant, and even in Galveston there are over a hundred business houses using Independent telephones, which have connection over Independent toll lines.

Below are given the total figures of the Independent telephone exchanges in the state of Texas, including the towns and cities where competition exists. This list, taken from towns having a population of 1,000 and over, gives us results as follows:

Towns and Cities.	Population.	Number of Subscribers.
72	470,500	23,170

The second division comprises the telephone plants known as sub-licensees. The exchanges in this group are operating over the Southwestern Bell company's toll lines, and are under a contract to use in this service, the Bell company's transmitter and receiver. The actual fulfillment of these contracts are no more insisted upon in this section of the country than they are throughout other states where the Bell company has contracted with the Independent people for similar service. The policy of the Bell company in Texas differs from that pursued in certain other territories in that these contracts are made from year to year. The total of towns under this heading follows:

Towns and Cities.	Population.	Number of Subscribers.
72	135,300	8,950

For the further purpose of showing the strength of the Independent movement in Texas, a list in full of the thirty-five towns wherein competition exists is here given. In connection with this list, I wish also to state that ten per cent will practically cover inaccuracies. The total presented will show that the Independent people have accomplished in four years all that the Bell company can claim after an existence of twenty-five years. Furthermore, the Independent people do not furnish service over party lines, nor do they add to their telephone list the hundred and one telephones which are located in the hallways of public buildings, about depots, hotels, etc. The list follows:

		—Subscribers—	
Town.	Population.	Independent.	Bell.
Abbott	1,000	50	50
Abilene	3,500	250	100
Arlington	1,100	50	50
Austin	25,000	860	1,100
Beaumont	20,000	900	900
Belton	3,700	150	100
Burnet	1,000	100	50
Corsicana	14,000	500	600
Dennison	16,000	700	500
Ennis	5,000	400	250
Flatonia	1,500	40	60
Fort Worth	45,000	2,000	3,750
Greenville	8,000	700	500
Gainsville	9,000	500	600
Houston	55,000	2,000	1,700
Itasca	2,000	120	100
La Grange	3,000	150	25
McGregor	2,000	200	150
Orange	7,500	500	500
Paris	15,000	900	700
Rockwell	1,500	100	75
Rusk	2,000	60	50
Sherman	16,000	600	700
San Antonio	60,000	2,300	900
San Marcus	3,000	150	100
Sherman Seymore	1,500	60	75
Texarkana	25,000	1,050	425
Taylor	5,000	250	200
Temple	7,000	575	500
Tyler	10,000	575	300
Waco	25,000	1,000	1,400
Waxahachie	5,000	360	150
Weatherford	5,000	200	175
West Texas	3,000	175	75
	405,300	18,461	16,910

Subtracting Dallas and Houston from the above stations gives us the following:

Towns.	Population.	Independent Subs.	Bell Subs.
33	315,300	18,461	10,110

These figures are based on an estimated population of

90,000 for the two cities, with a combined list of 6,800 subscribers.

A recapitulation of the telephone situation in Texas gives us the following:

	Towns.	Population.	Number of Subscribers.
Independent	144	605,800	32,120
Bell	126	711,400	35,770
Total	270	1,317,200	67,890

Comparing these totals with the Independent company's figures gives us a result in favor of the work performed by the Independent. If we subtract from the Bell company's list Dallas and Galveston, where competition does not exist, we would have approximately a population of 621,500 and a subscribers' list of 28,970, as against a population of 605,800 in the Independent field, furnishing service to 32,000 subscribers.

It will be seen from these totals that, adding Dallas and Galveston to the Independent list of exchanges, would give the Independent companies a larger list of subscribers, a greater number of exchanges, with practically the same population.

The data which I have submitted emphasizes an earlier statement made with regard to the telephone future in Texas. Of the total population furnished with telephone service—900,000—about 17,000 subscribers are using service furnished by both companies.

I have made these comparisons for the purpose of showing that Texas with a population of over 3,000,000 is supplying telephone service to but one-third of its people. These figures demonstrate the possibility in the telephone field for future development.

It is not my intention to claim an absolute victory for the Independent cause in Texas. I am rather disposed to employ some words of warning, and I trust that they may bear fruit. The Southwestern Bell Telephone Company is exerting every effort toward winning the business of the southwest. Not only are its officers and representatives men of strong personality and ability, but they are, and have been, on the ground for many years, and since the advent of Independent telephones have constantly kept their fingers on the popular pulse. Such competition can only be successfully combated by the employment of similar ammunition. I advise, therefore, not only a personal direction of affairs on the part of the financial interests which control the destinies of Independent telephony in Texas, but hard and conscientious work on the part of our younger people who are seeking a future in the Independent field.

A small fortune has been sent into Texas from other states for the construction of telephone properties, and is netting good returns; still it would seem that this is the time when the financiers who have fearlessly backed up their faith in Texas telephone properties with their money should look to its larger development.

There are many toll line systems in operation, some excellent and more that are doubtful. This applies only to the gradual development of toll lines by the Independent companies in different sections of the state. Many of these lines are at the present time being entirely rebuilt according to the latest standard construction. This system of toll lines is owned and operated by the Commercial Telephone Company and the Lone Star Long Distance Telephone Company, together with other territorial lines indirectly connected with the system, aggregating in all over 2,000 miles of toll line circuit, a large part of which is copper metallic and over which composite service is furnished.

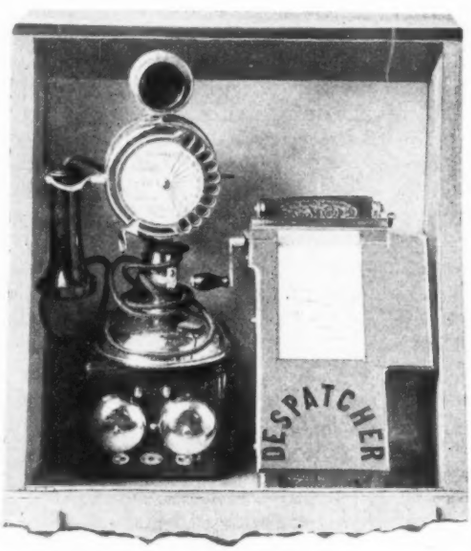
"SUNNY JIM."

TRAIN DISPATCHING ON INTERURBAN ROADS.

BY MILTON C. STERN.

Train dispatching by proper methods is as important to an interurban road as the tracks upon which the cars are run. How often one will read of a terrible collision and almost immediately the thought travels through the reader's mind, "What loss of life and expense is thus caused through someone's negligence." Why is it thus? As interurban travel is still in its infancy, this as well as other countries will see the day when this method of travel will become quite an important factor in the annals of trade and traffic; hence it behooves the careful and sagacious management to install a method which will overcome the possibilities of accident, loss of time, confusion and the like.

In my opinion the Egry system of train dispatching is a complete departure from the old method, as it provides security, protection and simplicity, yet produces dispatch to work and commands accuracy from employes. By this system written orders are required for all car movements, except, of course, where cars meet according to schedule. The method of placing these dispatching registers is generally



at the discretion of the road, whether they be placed on the cars, in pole boxes or at way stations.

The conductor, after writing the order, by the mere turning of the crank withdraws two copies of the order, one for the motorman and one for himself. The third copy remains in the register, access to which cannot be secured by anyone save the authorized official who has the key.

In receiving the order the conductor writes the order and reads it back for the dispatcher's "Complete." The extraction of one set of instruments brings another directly over the writing table for operation. In fact, the feed of the stationery is automatic, thus eliminating the necessity of carrying books in the pockets, doing away entirely with any other method of dispatching, and giving thereby a uniform system which produces all the requirements that the service dictates.

Too much stress cannot be placed upon the importance of these secret records, for, containing as they do every movement of the cars and orders issued, it becomes an easy matter to determine any leaks or loop holes, loss of time, causes of accident and party at fault, as well as other deficiencies. In my opinion, its adoption means the elimination of costly and inadequate methods for an economical and protective system, which has the endorsement of all of its users.

The accompanying cut shows the dispatcher in the pole box, together with the telephone.

Telephone Wire Plant

F. H. WHEELER.

There is probably no branch of engineering where the details of construction receive so little attention as in the wire plant of a small or medium sized telephone exchange. This is due to various reasons, but can be attributed principally to the fact that it is possible to get service from an indifferently constructed plant, and the necessity of paying for the service of competent engineers has not been apparent to promoters and investors in telephone properties.

It has been the custom of many telephone companies, which have not had the benefit of expert advice, to make a canvass of the various switchboards on the market and, after making more or less exhaustive inquiries into the merits and claims, as set forth by the manufacturers, select the type that appeals to them as the most suitable for their purpose. After the switchboard and apparatus have been purchased, the next step is to provide some means to complete the connection between the switchboard and the subscribers' apparatus.

In taking this step it has been the usual thing to consult with the manufacturer, or his agent, in regard to the method of construction and the class of material to be used. The purchaser does not reflect that the sales agent is not a telephone engineer and he may have been misled by this same agent, who, in his eagerness to serve his customer, has injudiciously advised the use of material that is fit only for the scrap pile. This can be explained in no other way than gross ignorance on the part of the salesman, who may imagine that a coil of fence wire, a cheap lineman and his switchboard are all that is necessary to make a modern telephone exchange.

It is a great mistake, and one that is frequently made by small companies, to purchase high-grade switchboard apparatus and connect it to a poorly constructed line, with the result that good service is impossible and the cost of maintenance is trebled.

The initial cost of a standard constructed pole line is somewhat greater than the ordinary fence wire juniper pole line, but, as an economical proposition, it is the only kind of construction that will insure good service to the subscribers and pay an honest dividend to the stockholders.

A dividend that is paid to the stockholders before a sufficient sum from the earnings of the company has been set apart to take care of the natural depreciation of the property is not an honest dividend, because it is applying money to one account at the expense of another, and that other account (the sinking fund for depreciation) should be the one most zealously guarded, for it is the life blood that perpetuates the very existence of the plant.

The art of pole line construction has not been changed materially since its incipiency, though the methods of construction have undergone a form of evolution that has varied somewhat with the different companies that have been in the field many years. The Bell company has had twenty-five years' experience in building and operating pole lines. It would be well for the Independent companies if more of them profited by the experience and mistakes of the Bell company along this line. Most of the large companies have been careful to adopt the good features of Bell construction and, in many instances, have introduced improvements.

In installing a new system, much depends upon the engineer or superintendent of construction. On his shoulders rests the responsibility for the weal or woe of the enterprise. He must be largely endowed with a quality known as "good horse sense," and be ready to take advantage of and overcome local conditions that are not down on the map. He must not only keep in touch with his work as it progresses, but must anticipate the future work to the extent that his men are always working to the best advantage; and above all, he must have an eagle eye for the dilatory ones, letting nothing pass his scrutiny that is not up to standard.

A great factor of expense in a telephone plant is the cost of maintenance. This cost can only be reduced to a minimum when the wire plant is built for the highest possible efficiency and laid out with a view, not only of present necessities, but for future growth.

A great many exchanges pay small dividends for no other reason than the outside construction has been done in a haphazard manner by a half baked "telephone man," whose sole claim to that title is his ability to climb a pole and put on a cross-arm indifferently.

Next in importance to the maintenance cost of the pole line is the all-important question of service. While the demand for good service in a small exchange may not be as imperative from the subscriber's standpoint as in the larger ones, the necessity for good construction is as great from an economical standpoint.

There are many forms of switchboards to select from; so, too, are there enumerable grades of material that enters the construction of a wire plant. It is frequently a difficult matter for the most experienced engineer to select the material that will prove the most economical for the plant; local conditions and requirements must determine many questions. It may be said, to the credit of the jobber, or manufacturer, that he invariably tries to sell high grade material; but if objections are made to the price quoted, he will generally offer a cheaper substitute. Again, there are articles on the market that are made to sell and are valuable for no other purpose. If one-half of the good things said of them were true, they would prove a panacea for all telephone ills.

A prospective investor in a plant for the manufacture of shoes or the building of an interurban railroad would be considered insane if he proposed to construct the manufacturing plant or build the railroad without first consulting a competent engineer. Yet this is precisely what is being done every day by Independent telephone companies, which are asking their friends, their neighbors and the public in general to invest in their enterprises.

The days of poleless and wireless telephony are not here as yet, and those who use that form of construction, or what is akin to it—separating a fence wire from mother earth with a sixteen-foot juniper pole—will have to rebuild the entire system before it will be voted a success by the telephone-using public.

The death knell of the tinware switchboard and the barb wire pole line has been sounded. Competition demands the best that science affords. It behooves the telephone manager and investor to see that nothing but the best is given him and that it is installed by competent, trustworthy men. In doing so he serves his own end and the public as well.

Specifications for 25-Foot Pole Line

CONSTRUCTION covered by these specifications includes all material used, and all methods followed conform to standard specifications.

The line should have an ultimate capacity of two six pin cross-arms and twelve wires, or two ten pin cross-arms and twenty wires. The wires should be of hard drawn copper.

The pole line should be located upon the most direct and practicable system of highways, crossing private property only to avoid abrupt turns, long detours, or trees and other serious obstacles.

Permanent right of way should be obtained for every pole, including the wires and attachments to be placed thereon. The lines should be located as straight as possible. Long curves should be avoided and reduced to straight sections and corners.

In locating a line on straight sections, stakes should be placed at equal distances of one hundred and thirty feet. The distance should be measured off without regard to obstacles, and the poles should be located as near the stakes as possible.

On curves and corners, poles should be spaced in accordance with the following table:

Amount of Pull.*	Span.
1 to 5 feet	130 feet
5 to 10 feet	120 feet
10 to 15 feet	110 feet
15 to 20 feet	100 feet
20 to 25 feet	90 feet
25 feet and over	75 feet

Wherever the "pull" is more than twenty-five feet the corner should be made on two poles. At right angle corners the section next to the corner pole should be not over seventy-five feet in length. At line terminals the last section should be not over seventy-five feet in length. At long spans, two hundred feet or over, the section each side of the long span should be not over seventy-five feet in length. Wherever the pole line changes from one side of the road to the other the crossing should be made at an angle of about forty-five degrees.

On railroad right of way no pole should be set at a distance of less than twelve feet from the edge of the nearest rail, unless the second cross-arm is more than twenty-two feet from the top of the rail. If this cross-arm is more than twenty-two feet from the top of the rail, the pole may be set not less than seven feet from the rail. In cities poles should be located as far as possible near the corners of intersecting streets, so as to permit of side guying.

The length of the poles should be proportioned to the contour of the country, so as to avoid abrupt changes in the level of the wires. To clear obstacles, poles of such length should be used as will allow the wires on two cross-arms to be at least four feet from the obstacle.

On highways where the cross-arms or wires extend, or are liable to extend, over any portion of the traveled road, all poles should extend at least nineteen feet above the surface of the ground. On suitable private right of way the poles need not extend above the ground more than fifteen feet.

At highway crossings the poles should be of such a height that no wire or other attachment to the poles should be less than eighteen feet above the crown of the highway. In order to give this height, the spacing of the cross-arms may be reduced to twelve inches on centers.

Where, on account of trees or other obstructions, long poles would otherwise be needed to give the required clearance for the wires, extension fixtures may be used, provided that, by this means, the required clearance can be obtained. Such fixtures should be used, however, only with the approval of the superintendent of construction.

In like cases the use of long poles may be avoided by reducing the spacing of the cross-arms to twelve inches if, by this means, the required clearance for the wires can be obtained. This should be done, however, only with the approval of the superintendent of construction. Cross-arms may, however, be spaced twelve inches on centers at highway crossings.

In distributing the poles the heaviest poles should be placed on corners and at the terminals of long spans. The straightest and best looking poles should be distributed through cities and towns and in front of residences.

Two braces should be attached to each cross-arms by means of carriage bolts. A round washer should be placed under the head of each bolt and the bolt driven into the cross-arm from the side next to the pole, so that the washer may rest in contact with the cross-arm.

Each cross-arm should be equipped with the full number of standard pins. Each pin should be nailed in the cross-arm with one six-penny nail, driven in straight from the middle of the side of the cross-arm.

The top of each pole should be roofed. Each pole should have two gains, four and one-fourth inches wide and one-half inch deep, spaced twenty-four inches on centers, except in the case of special construction to avoid obstacles. The center of the upper gain should be ten inches below the apex of the roof. A hole twenty-one thirty-seconds of an inch in diameter should be bored through the center of each gain.

All gains and the tops of all poles should be painted with one coat of Carbolineum Avenarius. All bolt holes at which arms are not to be attached should be given a coat of Carbolineum Avenarius.

A lightning rod of No. 6 galvanized iron wire (weight 540 lbs. per mile) should be attached to every tenth pole by staples spaced two feet apart. The rod should be attached before the pole is set and should extend the whole length of the pole and have two hand-turns on the bottom of the pole.

Each cross-arm should be attached to the pole by one cross-arm bolt, which should be long enough to go through the pole and cross-arm without cutting the back of the pole. The bolt should be driven through from the back of the pole, a square washer being placed under the head. A square washer should be placed under the nut. Each pair of braces should be attached to the pole by means of one fetter drive screw.

When the cross-arms are to be spaced twelve inches apart on centers, the cross-arm braces should be moved out on the arm so that the braces can be fastened to the pole in the usual position. For extension fixtures the braces should be fastened. On corner poles where the "pull" is fifteen feet or more at right angle corners ten pin cross-arms should be back braced.

Cable poles, office poles, all painted poles, and, in cities, all other poles exceeding fifty feet in length should be equipped with iron pole steps. The pole steps should be driven alternately into opposite sides of the pole in line with the cross-

*By the term "Pull" as used in construction work the distance is meant.

arms. If the pole is less than sixty-three inches in circumference, the pole steps should be spaced eighteen inches on centers. If the pole exceeds sixty-three inches in circumference the pole steps should be spaced twelve inches on centers. The bottom step should be on the sidewalk side of the pole and the lowest step on the street side should be not less than fourteen feet from the curb.

Below the iron steps, wooden pole steps should be used, spaced the same as the iron steps. Each wooden step should be fastened to the pole with two sixty-penny galvanized wire nails. Long span special fixtures over forty feet high should have at least one pole equipped with steps as specified above.

Poles should be set to the depths given in the following table:

Length of Pole. Feet or less.	Depth of Ground. Feet.	Depth in Solid Rock. Feet.
25	5	3
30	5½	3½
35	6	4
40	6	4
45	6½	4½
50	7	4½
55	7½	5
60	8	5
65	8½	
70	9	
75	9½	
80	10	
85	10½	
90	11	

All pole holes should be dug large enough to admit the pole without stabbing or hewing, and should be full size at the bottom, so as to admit of the use of iron tampers.

On straight lines the cross-arms should be placed at right angles to the direction of the line and the arms on adjacent poles shall face in opposite directions. On long sections the cross-arms on the terminal poles should be placed on the side of the pole away from the long section. At line terminals the cross-arms on the last two poles should be placed on the side of the pole facing the terminal. On curves the cross-arms should be placed on the side of the pole facing the middle of the curve. At road crossings the cross-arms should be placed on the side of the pole facing the road. On straight lines poles should be set vertically.

Corner poles should be raked when set. Where the "pull" is less than five feet the rake should be about ten inches. Where the "pull" is between five feet and ten feet the rake should be about fifteen inches. Where the "pull" is ten feet or more the rake should be about twenty-five inches.

After the pole is placed in position only one shovel should be used in filling the hole. Three tampers should be employed continuously to pack in the filling until the hole is completely filled. Soil should then be piled up above the surface and firmly packed around the pole.

In filling holes the coarse soil or gravel should be used at the top of the hole. Rock must be firmly wedged in around poles that are set in solid rock.

Where the ground is soft and re-enforcement for poles is necessary, a ground brace (or braces, using the top brace or both braces according to the nature of the soil), may be used. When extraordinary conditions exist the superintendent of construction should be consulted.

All plans for special fixtures should be submitted to the superintendent of construction for approval. Special fixtures, or towers, should be used at river crossings and spans more than three hundred feet in length.

Where the ground is soft and the right of way permits, "A" shaped fixtures may be used. "A" shaped fixtures should be set in the ground to a depth of from two to four feet, preferably the latter. All plans for bridge fixtures should be submitted to the superintendent of construction for approval.

For the purpose of strengthening curves and corners, the line should be re-enforced by guys, braces, or their approved equivalent.

On a line with not more than twelve wires, and where the "pull" is less than five feet guying will, in general, not be necessary. Where the pull is five to ten feet re-enforcement at the butt may be used as a substitute for guying. Where the "pull" exceeds ten feet poles should be guyed.

In swamps and light sands, or at any point where the pole setting is insecure, guys or re-enforcement must be applied to poles having a "pull" of less than five feet. For more than twelve wires all corner poles should be guyed.

Wherever the line makes a right angle corner on two poles, the poles should be guyed. Wherever the line crosses from one side of the road to the other, the corner poles should be guyed. The terminal poles at any span of two hundred feet or more should be head guyed, and, if possible, side guyed in both directions.

A "push" brace is equivalent to a side guy in one direction. A "pull and push" brace is equivalent to side guying in both directions. Double pole braces are equivalent to side guys in both directions. This method of bracing may be used where rock, quicksand or other obstacles render the cost of the standard bracing or guying excessive. A ground brace may be used to hold light "pulls" in soft ground, to re-enforce poles in soft ground, and where guys or pole braces cannot be used. "A" shaped fixtures should be considered the equivalent of side guys in both directions.

In locating anchor guys the distance from the butt of the pole to the anchor should be made as great as possible and in no case should it be less than one-fifth the length of the pole. Each anchor log should be fitted with a guy rod. The guy rod should pass through the anchor log and should be held by a nut and square washer.

All excavations for anchor logs should be five feet deep, where practicable. If impracticable to obtain this depth, on account of the nature of the ground, the excavation may be made not less than three and one-half feet deep.

The size of the anchor log used should correspond to the depth of the excavation, according to the following table:

DEPTH OF EXCAVATION	DIMENSIONS OF ANCHOR LOG	
	Length	Diameter
5 feet	5 feet	10 inches
4 "	5 "	16 "
	8 "	10 "
3½ "	5 "	23 "
	8 "	14 "
	10 "	12 "

The log should be firmly anchored by covering it with planks, logs or rocks.

When logs of large diameter are not available, cross pieces may be laid across the anchor, such pieces being twice as long as the diameter given above. In no case should a log less than ten inches in diameter be used.

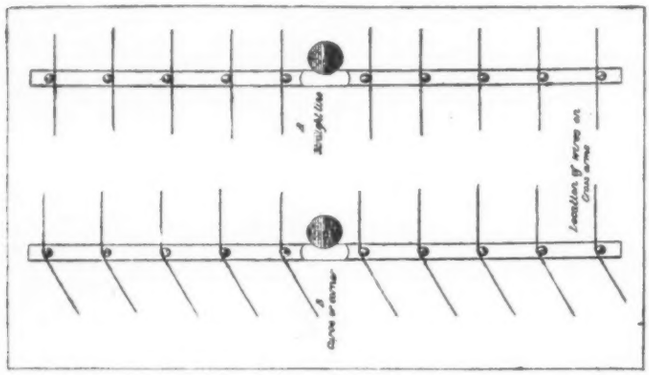
The top of each guy stub should be pointed to an angle of sixty degrees and should be painted with one coat of carbolineum avenarius. Each guy stub should be set in the ground to a depth of at least five feet. The stub should be set so as to lean away from the pole. The butt of each brace should be set at least three and one-half feet in the ground and should be supported on plank, large stone or solid ledge. The butt of each brace should be set at least five feet in the ground.

Guy strand should be used for all guys. With one cross-arm, guys should be attached to the pole under the second gain. With two cross-arms guys should be attached above the second gain. Head guys from the top of one pole to an adjacent pole should be attached to the latter as near the

ground as possible. Guys should be pulled up by means of a chain and fastened with one guy clamp at each end. A thimble should be used in attaching a guy to a guy bolt or guy rod. The end of a guy attached to a pole or stub should be wrapped twice about the pole or stub, and the wrapping may be held in place on the back of the pole by five staples. Guys may be anchored to rock, trees, anchor logs, or guy stubs. When the rock is solid the guy should be anchored. When the rock is not firm and is likely to split off, the guy should be anchored, the length of the bolt being determined by the nature of the rock. Guys may be attached to suitable trees, provided the right of way permits.

The guy should preferably be attached to the tree trunk. In exceptional cases it may be attached to a live limb close to the trunk, provided the limb has a diameter exceeding five inches. The trunk or limb of the tree should be protected from injury by being covered with strips of hard wood; each strip should be not less than one inch thick and twelve inches long and not over two inches wide. The guy should be wrapped at least twice about the tree and fastened with one guy clamp. Guys may be attached to anchor logs of the character hereinbefore specified. For the purpose of clearing obstacles, guys may be attached to guy stubs. When possible the guy stub should be anchor guyed. Where not possible the guy stub may be braced. Guys should not be attached to buildings, bridges, or other structures unless specially authorized by the superintendent of construction.

In addition to guys used for holding corners or curves, storm guys should be provided. On a line carrying twenty



wires, corner poles, at right angle corners, road crossings, and where the "pull" is twenty-five feet or more, should be head guyed if there are forty or more poles in a straight section next to the corner pole. On a line carrying twenty wires, straight sections of line should be head and side guyed in both directions as follows: When the number of poles in a straight section is less than eighty, no guys are needed. When the number of poles in a straight section is from eighty to one hundred inclusive, the middle pole of the section should be guyed. When the number of poles in a straight section is from one hundred and one to one hundred and fifty, inclusive, the poles at one-third and two thirds of the total distance should be guyed. When the number of poles in a straight section is one hundred and fifty-one or more, start at each end of the section and guy every fortieth pole until the remaining section is between forty and eighty poles inclusive. When this remaining section is between forty and fifty-nine poles inclusive no guys are needed. When this remaining section is between sixty and eighty poles inclusive the middle pole of the section should be guyed.

All trees close to the line should be trimmed so as to clear the wires on two cross-arms by a distance of at least four feet in all directions. All dead trees which would injure the line by falling should be cut down. Before trimming or cutting trees permission should first be obtained from the owner or the proper authorities.

The line wire should be of hard drawn copper of the sizes No. 8 B. W. G., No. 12 N. B. S. G. or No. 14 N. B. S. G. On long spans, three hundred feet or over, the superintendent of construction should be consulted as to what kind of wire should be used and the amount of sag that should be given. Wires of the same size should be pulled up with apparatus specially designed for the purpose. If six wires are being pulled up a three sheave block should be used; if eight wires, a four sheave block; and if ten wires, a five sheave block. The wires should be strung with a uniform sag so that all the wires on each cross-arm should be even and level, except where No. 14 wires are on the same arm with No. 8 or No. 12 wires.

The sag for No. 8 or No. 12 wires should be as given in the following table, making the allowance therein stated for temperature and length of span:

Temp. Degrees Fahr.	LENGTH OF SPAN IN FEET					
	75	100	115	130	150	200
	Sag in Inches					
— 30	1	2	2½	3½	4½	8
— 10	1½	2½	3	4	5	9
+ 10	1½	3	3½	4½	6	10½
+ 30	2	3	4	5½	7	12
+ 60	2½	4½	5½	7	9	15½
+ 80	3	5½	7	8½	11½	19
+ 100	5½	7	9	11	14	22½

The sag for No. 14 wires should be at least two inches greater than that indicated in the table for the same temperature and span. On straight lines the wires should be tied to the insulators in the position shown at "A," in the diagram. On curves and corners the wires should be tied to the insulators in the position shown at "B" in the diagram.

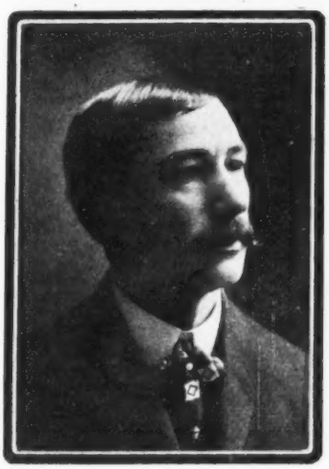
The line wires should be tied to the insulators in the manner shown in the diagram. It will be noticed that one side of the tie wire passes over the line wire and makes five complete turns, and the other side passes under the line wire and makes five complete turns.

The joints in the copper wires should be made with "McIntire" sleeves. Each standard sleeve for No. 14 N. B. S. G. or No. 12 N. B. S. G. should have four complete twists; each standard sleeve for No. 8 B. W. G. should have four and one-half complete twists. With the regular "McIntire" sleeves, each sleeve for No. 14 N. B. S. G. or No. 12 N. B. S. G. should have three complete twists; each sleeve for No. 8 B. W. G. should have three and one-half complete twists. Where it is necessary to dead end a line, as at a point where a run-in is to be made to an office or cable, the wire should be attached to the insulator and fastened with a half sleeve. One and a half twists should be given the half sleeve.

The following specifications form a portion of the subsidiary specifications: Cedar poles, chestnut poles, juniper poles, pole braces, guy stubs and anchor logs; wooden pole steps, painted cross-arms of Norway pine, yellow pine, cypress or fir; creosoted cross-arms of Norway pine or yellow pine; creosoting of small timber; dead oil of coal tar or coal tar creosote; analysis of dead oil of coal tar or coal tar creosote; standard pins and transposition pins; standard insulators and transposition insulators; pole line hardware; nails; best-best galvanized iron wire; galvanized steel seven wire strand (mild steel); extension fixture; galvanized braces for outrigger cross-arms; special rock guy bolt; galvanizing for iron and steel; carbolineum avenarius; hard drawn copper wire; connecting sleeves; tie wires and standard green pole paint.

Louisville, Ky., is to have telephones on her street cars, so as to enable motormen to talk from various points along the line to the central offices, by means of a system of plugs and switches in the rails.

Kankakee's New Telephone System



A. J. VERNIER.

THE Independent Construction Company, with offices in Archibald, Ohio, and Kankakee, Illinois, is rapidly completing a telephone system for the Eastern Illinois Independent Telephone Company at Kankakee, that promises to be one of the best in the entire state. The Eastern Illinois Independent Telephone Company has franchises in Kankakee, Manteno, Bradley, Bourbonnais and Grant Park, and expects to secure others at an early date, which will give it practical control of Kankakee county. The exchange at Manteno is completed and is proving a great success.

The home of the Kankakee exchange has been built especially for it at a cost of $25,000. The company will occupy the entire second floor of the building, utilizing the front for offices. One side will be used for lounging rooms, lockers, and the like, and the remaining space for terminal operating rooms. The subdivisions require 4,900 square feet of floor space, all of which is utilized.

The switchboard is full central energy, having a present installed capacity of 1,600 instruments. Being full multiple, it is trunked to accommodate 2,400 subscribers. The prospectus of the Eastern Illinois Company says that Kankakee has a population of 15,000, and is destined to become a city of 25,000 owing to its geographical situation and many natural advantages. The company's faith in the city is exemplified by its generous expenditure of money in providing a plant that will take care of new business.

Two miles of system is underground, requiring 65,000 feet of conduit. All of the business district and a portion of the residence districts is thus equipped, and it is claimed that more conduit has been used in constructing the plant than has ever been required in any other city of similar size in the country. The underground capacity will handle 6,000 telephones.

All cable and terminal poles are of Idaho cedar. This pole is also used exclusively in the business district where required. Terminal poles are provided with circle tops, connected to subscribers' instruments with twisted copper duplex wire, a method which minimizes trouble, prevents crosses, and has proven most economical to maintain. No cross arms are used in the business district of the city. All other poles are of best quality Wisconsin and Michigan cedar.

The construction is modern in every respect and has had the personal supervision of the general manager of the Independent Construction Company, A. J. Vernier. No more than two cross arms are used in the residence portion of the city; cables being used very largely in the distribution of service. This practice naturally curtails the need of much aerial wire and produces a better effect both in sightliness and efficiency. Sixty terminals and cable poles are found to be necessary to facilitate distribution, the general tendency being to enter the wire underground at the nearest point. Over 50,000 feet of cable will be used to complete the system for immediate use. Nothing but the best has been purchased and it has been handled throughout by men of practical experience.

At a conservative estimate the company will open its system to the public with 1,000 telephones installed. The rates will be as follows: Business houses, $30; residences, $18, and farmers, $15 per year. In this connection it might be well to state that the farmers of Kankakee county are being well provided for and are among the company's most enthusiastic patrons. Many farmers' lines have already been completed.

When the company is in full operation it will own all of the toll lines in its county and have lines in adjoining counties. It will offer connections with 60,000 telephones in Indiana, by means of the new long distance system of that state, which also connects with the United States Long Distance Company of Ohio. Connection with the Interstate Independent long distance system will give Kankakee subscribers 10,000 additional telephones at Aurora, Joliet, Elgin, Peoria and Springfield. It is believed that this latter company will have connections with the automatic system in Chicago not later than October of this year.

The Eastern Illinois Independent Telephone Company in its argument to prospective patrons says:

Independent companies are springing up over night, and, almost without exception, they are successful from the very start. To begin with, some of the Bell system in our town is not first class. It is as much behind the times as the first locomotive, the old style, high-wheeled bicycle, or the first model of an automobile. These were all wonders in their time, but their proper place to-day is in the museum.

The Bell monopoly, intrenched behind patent rights, extorted

INDEPENDENT TELEPHONE EXCHANGE BUILDING, KANKAKEE.

high rates for inferior service, long after the progress of invention made better service possible. Their dog in the manger policy of refusing either to adopt improvements themselves or to allow more progressive concerns to enter the field as long as their patents were in force is now bearing its proper results. As soon as the original Bell patents expired the public gave active support to the hundreds of Independent companies which promised and gave better service than the old companies extended. These Independent companies rendered such prompt, efficient and economical service and such courteous treatment that by May, 1903, the Independent telephones in the United States actually outnumbered the Bell telephones.

The Independent movement is gaining ground every day. In order to appreciate the full significance of these facts remember, please, that the Independent companies have been in operation only seven years, as against a quarter of a century for the Bell monopoly; that the Bell people had a tremendous advantage from the start—their plants were in actual operation and the people had to take Bell service or none; that usually merchants were compelled to retain their Bell telephones, in addition to subscribing for the Independent ones, in order to keep in touch with all the subscribers in a town or city, and business men finally realized that the only way to bring this monopoly to terms was to encourage competition; that the Independents had to fight for the right to install their service against an old established and powerful organization.

The Independent companies were compelled to give first-class service in every respect. In no other way could they have secured a foothold. They won out because the Bell people would not keep their facilities in line with the progress of invention. It is a mistake to suppose, as many do, that the Independent movement cannot succeed in large cities and towns and that it will be useful in the country and in small towns only. Look at these facts and decide for yourself. The situation in one hundred of the largest cities in the United States is as follows:

Sixty-seven of these cities already have Independent exchanges in operation and franchises are being actively sought in the majority of the remaining ones. To-day Independent companies are organized and in operation in St. Louis, Pittsburg, Philadelphia, Louisville, Minneapolis, St. Paul, Dayton, Indianapolis, Rochester, Buffalo, Toledo and Columbus. Detroit, Kansas City and San Francisco are now installing Independent service. In Chicago the Independent company has constructed a conduit for its cables forty feet underground in the very heart of the city, at the enormous cost of over $4,000,000. This company now has more than 5,000 instruments in service. It is claimed that Chicago will have the finest telephone system in the world when it is completed. At present only the business part of the city is reached, but it is the intention to push the work and extend the service to residential portions as quickly as possible. In Cincinnati an Independent company now has a franchise and $6,000,000 has been subscribed by Cincinnati people to build a system.

CONSTRUCTION CREW THAT BUILT THE KANKAKEE SYSTEM.

These facts dispel the notion that Independent companies cannot compete with the Bell lessees. The most progressive men in the business world are engaged in the new movement, which is being extended hourly.

You will note in the list of our officers and directors the names of some of the best known business men in this community, with many others whose names do not appear. The men engaged for the construction and operating departments of our system are the most experienced we could find. In the past six years they have built eleven Independent telephone plants for cities in Ohio and Indiana, and we now propose to extend their operations to Kanka-

Our officers are as follows: President, J. Frank Leonard, vice president First National Bank, Kankakee, Ill.; vice president, William Fraser, assistant cashier Eastern Illinois Trust and Savings Bank, Kankakee, Ill.; secretary, William H. Radeke, president of the Radeke Brewing Company; financial secretary, Anatole J. Drolet, formerly cashier and bookkeeper of the W. S. Vanderwater Company; treasurer, Thomas A. Legris, formerly with Legris Brothers & Fraser Bank. Directors: J. Frank Leonard, Thomas A. Legris, William H. Radeke, Louis E. Beckman, William Fraser, A. J. Vernier, L. D. Gotshall, C. M. McLaughlin, I. W. Gotshall, George H. Probeck, Charles N. King.

We are building in Kankakee the most efficient plant for telephone service that practical telephone experience, skill and capital can construct. We shall give to our patrons at once a service far superior to that which the Bell monopoly has rendered, because our facilities will be the most modern known to the science of sound transmission. Furthermore, we promise the people of this city that in the future we will keep up with the progress of invention in telephone construction, and they may be confident always of receiving from us the best service it is possible to give.

We are putting in more underground work than any telephone company has yet constructed for a city of this size. Such construction is more costly to install and less costly to maintain and operate. It does away entirely with overhead wires, which are so liable to damage during severe storms, and which are more easily put out of order than the underground wires. Our system in Kankakee includes three and one-half miles of underground work of the very finest and most durable kind. Service on such a line is not so liable to interruption for repairs.

Only individual, full metallic lines, will be installed. Our switchboard will be the flashlight, visual design, one of the most modern and efficient of the various makes; it will be wired for 1,600 independent, full metallic lines and will have a trunking capacity of 2,400 individual full metallic lines. With this board the operator can give you connections in from *three to six seconds*, compared with from one-half minute to one-half hour on the old style switchboard.

We will be always alert to improve our service, not alone in mechanical equipment but in extending the courtesies which subscribers have a right to expect, when they pay for telephone service. The argument that a firm must use both telephones is no better than to say that the advertiser must use all advertising mediums. Your friends will be on the Independent.

The best newspaper and the best telephone service will undoubtedly draw to its patronage in time the most desirable and profitable constituency.

The Bell patents have expired, not only by the patent laws, but from general debility. The Bell Company never rendered the best of service, even when it had the field to itself. Its plants are not being kept up to date and the service they can render must constantly decrease in value to the commercial world. Why should you patronize them when more efficient service, at the same cost, is ringing you up?

The difference between good and poor service is 100 per cent. Good service is a paying investment; poor service is constant expense. Independent service has been successful throughout the country and under a great variety of conditions. We are not asking support for an experiment, but for a demonstrated business success.

QUESTIONS AND ANSWERS

Conducted by J. C. Kelsey, Purdue University, Lafayette, Indiana.

How far apart should grounded lines be constructed, so there will be no cross talk? Would two grounded lines built on opposite sides of a country road, parallel for about four miles, where they cross each other at right angles at three places, with a distance of thirty feet between, be bothered with cross talk? We are thinking of building a line, having the conditions of the second question, but do not want to do so if there will be cross talk. The proposed line is to have bridged 1,600 ohm bells.—B. C. Tel Co.

I don't think that you can build a line, or lines, under conditions named, that will not give a Babel of cross talk. It makes no difference how much the lines cross each other, right angles, acute angles, or any way, the cross talk will be vigorous. I would not guarantee freedom from cross talk if your proposed wires were to be on section roads, one mile apart.

I wish to purchase something in the line of a wireless telephone, for telephoning between rooms, the distance between rooms being from 50 to 200 feet. I want simple apparatus, in the nature of a single pair of telephones that have no ringing attachment, and one in which I could attach first-class transmitters and receivers, some of which I already have. Is it possible to obtain the apparatus described?—Cinc. W. B. N.

I have no knowledge of such simple devices for the purpose of wireless telephony. There are several developments along wireless lines, all of which seem to be complicated. Apparently, the best posted man in wireless telephony is Mr. Collins of New York, who has been a contributor to the pages of TELEPHONY. In connection with the first question, I might state that before we tried the Mississippi river in wireless talking, we experimented in the building of the Northwestern Telephone Company. By stretching wires in rooms, fifty feet apart, and connecting to the ordinary plumbing for a return, we got very satisfactory communication between rooms. The communication was simple by the means of exaggerated cross talk between two grounded lines. We found that the wires in the rooms did not necessarily have to parallel one another, in order to give transmission, although for greater distances we found that paralleling helped. I could not suggest any way you could use the method, other than the way mentioned. Ordinary transmitters, receivers and dry batteries were all that we needed.

We want to adopt telephone service in our mines. We are afraid that lightning will enter the mine, and set fire to it. Would it be advisable to use grounded lines, of rubber covered wire, or would it be preferable to use metallic lines? What lightning protection would you advise?—J. W., Mo.

This is a very important question. I naturally advise metallic service for all conditions. There would be convenience in one wire, and there is great opportunity of finding a good ground in a mine. There would be no difference in the safety factor; however, both grounded and metallic circuits should be protected at the entrance of the mine with fuses and carbon arresters. With carbon arresters in proper shape, and a straight ground rod, running to a real ground, there would be danger of a flashing across the instrument terminals in the mine. Of course, if a real bolt of lightning struck the line, fuses and arresters would be of no avail, and the mine would be in danger, even if no wires were present. Lightning is apparently an oscillating discharge, and it would be just as fair to say that the lightning started from the mine, as to say that the lightning struck the mine. The charges that the arresters detect and take charge of, are only induced charges from a storm several miles away. If you do not care to trust the arresters and fuses alone, you could insert a 40-ohm ringer coil in your line, after you leave the arrester to drop into the mine. This would cause the lightning charge to prefer even a crooked ground path, in preference to entering the mine. Owing to the rapid oscillations, the 40-ohm coil would develop an enormous resistance to the charge, without being really detrimental to voice currents. I think that you may reasonably trust the modern carbon arrester and heating coil. Rubber covered wire would not have any bearing on lightning conditions.

What is a condenser used for, and how can it be tested?—G. D. B.

A condenser plays a most important part in common battery telephone practice. It allows alternating, or pulsating, current to flow through its interior, so to speak, and does not permit direct current to flow. The common battery subscriber's telephone has a condenser in series with the ringer, which allows the bell to ring by means of alternating current, but the signals are not affected until the removal of the receiver from the hook allows direct current to flow through the respective relays. A short circuited condenser reveals itself by a permanent line signal at the central office, and a line measurement of 1,200 ohms, where the ordinary open circuit measurement is 200 ohms, for instance. This proves at once that the condenser has placed the ringers in the line circuit, on the supposition that the ringers are 1,000 ohms in resistance. To test the condenser, put the receiver across the line with the condenser in series, and if central answers, you may know the condenser is short circuited. Or put it across the line and let a charge soak in. An instant later, short circuit with a pair of pliers, or a wire, and a spark indicates that the condenser will retain a charge and can be replaced in the ringer circuit. Sometimes, short circuited condensers are placed across a 110-volt direct current circuit, and blown out. I have tried them on 500 volts, and few condensers will stand such a test.

What is the effect of a short circuited condenser upon a common battery trunk circuit?—G. D. B.

From your list of questions, I take it that you mean the standard Bell trunk circuit. If you mean the condenser placed in the trunk repeating coil, on the trunk side, then the effect will be to give the "A" operator a previous signal, falsely telling that the "B" subscriber has answered, and also preventing "A" from getting a disconnect from the "B" subscriber. It would also prevent the operation of the signals at the "B" end of the circuit. The high resistance relay would not operate the disconnect lamp, nor would the answering of the "B" subscriber lock out the ringing lamp. In fact, a short circuited condenser at such a place renders the entire circuit inoperative.

What is the effect of a reversed coil in the Bell subscribers' instrument when the place marked 1 is not attached to the line, as it should be?—G. D. B.

You refer to the No. 21 induction coil, in which the secondary windings are marked 1 and 2, while the primary windings are marked 3 and 4. If either of these coils are

reversed, such as 2 being connected to the line, and 1 to the hook, the effect is that the talker cannot be heard. That is, transmission is very poor. With connection 1 connected to the line, and 2 to the hook, 3 to the receiver, and 4 to the condenser, the secondary winding, being in the transmitter circuit, does not offer any impedance to the voice currents. But if the connections are reversed, the secondary winding is not neutralized by the primary winding, hence the secondary winding becomes highly inductive, and weakens the voice currents passing through. It flattens them, or rather, muffles them. The effect is very evident, and a kick from the subscriber immediately follows the installation of an instrument, with coil reversed.

What is the difference between an inductive coil, and a non-inductive coil?

Non-inductive coils are those in which the self-inductive properties of the coils are neutralized. Relays placed in the talking circuit are necessarily non-inductive, and are made so by a few turns of german silver wire wound in parallel connection with the active, or copper winding. The same relay could be made non-inductive by paralleling the winding with a condenser. Another way to produce a non-inductive relay is to wind it differentially; that is, have two windings on the same core, wound in pairs .each winding connected to opposite sides of a talking circuit, so that the energy of one winding will neutralize the energy in the other. Coils are made actually non-inductive by a few copper short circuiting turns around the core before the copper winding is put on. Motors are built in which the speed is considerably reduced by the use of short circuited coils about the armature core, before the active windings are put on. The ordinary relay is a form of inductive winding. If you break a battery circuit through this inductive relay, say a 20-volt battery, you are aware of it by a sharp shock. Twenty volts would not give such a shock. It comes from the stored-up energy in the core, which, when the circuit is opened, dissipates itself. Having nothing in the way, the lines of force rapidly disappear, and cut the winding in the quickest possible time. As the voltage depends upon speed of cutting, number of conductors to be cut, and the number of lines of force engaged, you may see that the breaking of the circuit will give a higher voltage, or a greater shock, than the making of the circuit through the coil.

Could a series telephone with eighty ohm ringers, connected direct to switchboard, be switched onto a 1,600 ohm ringer and give satisfactory result if the operator did the signaling on rural lines? Will it bring the talking efficiency up to put in high wound induction coils?—P.

Yes. When the series subscriber removes his receiver to talk to the bridging party, the conditions are exactly the same, with the exception of 1,600 ohm ringer across the line. From what I glean, you are having mixed service, series instruments running into eighty ohm drops at switchboard, and 1,600 bridging instruments connected to same switchboard with bridging drops. If I understand the question aright, I can see no difficulty in mixing the service, if the operator does the ringing with a suitable generator. The talking efficiency, ordinarily, would not be improved by high wound induction coils. It is always a question of conditions and circumstances. Nothing short of a real test would be reliable information.

Can Ohm's law be applied to high potential discharges, such as a flash of lightning, to terminate its probable course when it has struck or charged a telephone line, fully metallic.—H. A. D.

Ohm's law only applies to direct currents. For alternating currents it does not apply in the true sense of the word, as the current is equal to the voltage at any instant divided by the impedance of the circuit. In direct currents resistance is the only factor, but in alternating, pulsating, or oscillating currents, an extra factor in the shape of retardation enters. The retardation depends upon the frequency of the alternations, pulsations or oscillations, and it is plain that they vary widely for different frequency values. I cannot conceive of the summary termination of a course of lightning charge, but I can conceive of the *deflection* of the charge. Lightning seems to be a current, oscillating in character, of great frequency. The average lightning arrestor takes advantage of this by inserting an impedance in a line as it leaves the dynamo. The line is nearly in earth connection through a small air gap. The rapid oscillations, striking the line, try to pass through the impedance. But the impedance, which may have a very small resistance to direct currents, suddenly interposes such a great resistance to the lightning charge that it prefers to jump over the air gap to ground. I venture to say that if real lightning charges strike the line, arrestor and all will be destroyed. It is only the charge induced from a distant stroke of lightning that the line feels. I cannot see how Ohm's law could be applied, not only because high potential discharges are oscillating in character, but because the frequency and potential is unknown.

What should be the milli-amperes of a current and the voltage of a 100,000 ohm bridging generator? What strength of generator and ringer would you recommend for a twenty party line, grounded, No. 12 iron wire on glass insulators?—D. W. C., O.

A bridging generator should give a voltage of 100, on open load, and not less than 65 on full load. The 100,000 ohm feature is misleading, and tells nothing of the output of the generator. It might, however, be a measure of the sensitiveness of a ringer when acted upon by the generator through a resistance of 100,000. But that knowledge would not be valuable to any one. For a twenty party line, 2,000 ohm ringers and five-bar generators would give best service. Ordinarily, the general distinction between the series and bridging generator lies in the number of bars. The series would have three bars, while the bridging from four to five.

In April TELEPHONY we gave an extended description of a very perplexing case of local induction in our switchboard. You suggested that it was caused from a defective transformer. We examined the large transformer that supplies current to the commercial circuit to which this building is wired and found a rather startling state of affairs. Some electrician (?) in attempting to wire a lightning arrester had actually fastened together a primary and secondary drop so that one side of a 2,000-volt current was thrown directly onto one side of the main distributing circuit. We had this wiring changed and our local switchboard induction has disappeared.—E. O. C. Co.

Comment is unnecessary.

"HELLO" GIRLS AS HEROINES.

Talk about Casabianaca! He is not the only one who has "stood on the burning deck." At Cleveland, Ohio, sixty brave "hello" girls in the exchange of the Cuyahoga Telephone company stuck heroically to their posts for a quarter of an hour while a fire burned back of the switchboard at which they were working. With the big room filling rapidly with suffocating fumes that nearly strangled them, the plucky young women answered calls as calmly as though nothing out of the ordinary was happening. From the smoke the telephone girls could only guess the extent of the fire, yet they did not move from their chairs or take the steel "bonnets" from their heads. There's real heroism for you! the kind that wins admiration from the whole world. And if the Cuyahoga company doesn't show its appreciation of the loyalty and remarkable nerve in this instance of its fair employes, who remained at their posts in the face of peril—as cool and daring an achievement as one ever hears of outside of actual warfare—then it doesn't realize what a noble, well-disciplined set of "hello girls" it has in its employ. They certainly deserve full meed of praise for their heroic conduct.

The Telephone as a Business Proposition

B. G. HUBBELL.

SOME twenty-five years have elapsed since the telephone first came to be used in a commercial way. This great invention, at its birth used simply as a toy, has come to be an absolute necessity in social and business life. In the history of all inventions there has been nothing which has so quickly and so thoroughly intrenched itself in public favor as the telephone.

All indications point to an ever-increasing demand for telephone service. There is no business more reliable. It is not dependent upon any whim or fashion, nor do any of the disturbing factors so likely to interfere with the conduct of all other lines of business in the least affect the telephone.

Whatever political party is in power; whatever foreign nations are at war, makes no difference with the necessity of the telephone in all business and social lines.

There is probably no line in which there is less danger of unforeseen losses through catastrophes than in the telephone business. One reads in almost every issue of the daily press of some terrible accident on steam and electric roads or in great manufacturing enterprises, in which the losses run up to fabulous amounts. It frequently happens that a single accident due to any of these causes, disturbs the dividends of corporations for many years. The telephone business is not conducted in a manner to have such experiences.

As an example of the way the public has accepted the telephone as an absolute necessity to the daily life of our people, it may be said that in the twenty-five years in which the American Bell Telephone Company has been in operation, it has succeeded in securing about one and one-quarter millions subscribers. Vast as this number certainly is, a still more startling growth is shown in the organization of Independent companies throughout the United States, whose subscribers secured in some eight years now aggregate considerably over two millions in number. With these astounding figures, increasing, practically, every day, by thousands, throughout the country, it would be difficult to imagine a proposition which is more stable, more reliable and of more general merit, than the telephone business.

One might consider that with these enormous figures there may be a lessening of the demand for telephones in the future; but, in view of the fact that some European countries, notably Sweden, have in operation to-day practically five times as many telephones in proportion to their population as are in use in the United States, there need be no question but that within a very few years the number of telephone subscribers in this country will be doubled, trebled, and perhaps quadrupled.

It is safe to say that there is no line of business in the country to-day where the profits have been so enormous as they have been in the telephone business. Statistics show that the original investors in the Bell Telephone company some twenty-five years ago, have made in excess of $20,000 profit on each $100 invested in that organization. This enormous profit was made in the face of many discouraging features. Lack of experience in methods of construction and operation, the frequent necessity of rebuilding plants, taking out inefficient switchboards and telephones and replacing them by newer and more modern apparatus, have cost the Bell company millions of dollars. The Bell company also was at a further considerable cost in popularizing the business and in developing a demand for its service.

The telephone business offers the same opportunity to-day for profit that was offered to the original investor, and there ought to be better opportunities, from the fact that the experimental stage has been passed, and investments to-day, in his line of work, can be made a much less cost per instrument than heretofore, and besides this, the cost of maintenance has decreased in relative proportion as well.

During the past eight years the enormous sum of $200,000,000 has been invested in the construction of Independent telephone systems throughout the United States. There are in existence to-day over seven thousand Independent telephone organizations.

The question is often asked as a general proposition, whether moneys invested in the Independent telephone systems, in competition with the Bell, have been earning satisfactory returns. On this point one of the best posted men in the country on the telephone business makes the following statement:

> The Independent telephone companies came into the field to reduce rates, and are a direct result of the alleged extortionate demand on the part of the Bell company. The ability of the Independent companies to reduce rates, comes from the fact that these companies do not have to labor under the disadvantages which exist with respect to the old Bell companies.
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> The Bell company is compelled by contract to pay a royalty on every telephone it uses. It further has an excessive capitalization on which interest must be paid. The capitalization has been brought about largely by the many changes it was found necessary to make in the Bell system, while it was passing through the experimental stages.
>
> The Bell organization had to rebuild nearly all its telephone properties several times before it was able to produce a satisfactory service in the communities in which it operated. It is still confronted at this late day, in the development of telephone art, with the necessity of rebuilding a large number of its plants in the western and central parts of New York state, as well as in other parts of the country. All of these conditions mean, however, a large expenditure of money, increase of capitalization, whether by the sale of stock or bonds, and of necessity an increase of revenue to provide the interest on such increased capitalization. These costly experiments which have been borne by the Bell company have not been experienced by these Independent companies which have been organized so largely since the expiration of the Bell patents.
>
> The Independent companies, building at a later day in the development of telephone art, have been able to provide themselves with the latest improvements at reduced cost, and have not been subjected to the extreme expense of experimental stages, nor are they subjected to the arduous task of providing revenues for the heavy royalty on each telephone they have in service. They are, however, in a position with low capitalization to furnish telephone service at a cheaper rate than can be furnished by the Bell company.
>
> The truth of these conclusions is shown by the fact that while there are in the United States something like seven thousand Independent telephone companies, which have been organized during the past eight years, there have been but twenty-two companies in all this number that have not been eminently successful. The failure of these twenty-two was in no case complete, but the trouble was for the most part, due to the fact that they were organized and conducted by men inexperienced in the telephone business. They have almost uniformly been reorganized, put in first-class shape, and have taken their position with the enormous list of successful Independent telephone companies.
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> Comparing the record of failures, so called, of Independent telephone companies with that of National banks, it appears that the failures of banks have been more in number each year than that of Independent telephone companies in eight years. It is thus made evident that while the Independent companies have reduced the expense to telephone users, they have at the same time presented an unparalleled financial success.

The question is often asked whether the Independent com-

panies are holding their own with the Bell company in securing subscribers. It is expected, when a new company enters the field in opposition to a long-established business concern, in almost every line of business, that a sharp struggle must ensue before the newcomer secures a foothold of sufficient strength to enable it to maintain itself successfully. The new organization must spend large sums of money in acquainting the public with its advantages; ordinarily it is content to spend years in persistent efforts to build up its business before expecting a business to compare favorably with its older competitors. This cost of introduction to the public is, ordinarily, of considerable amount, and new enterprises, therefore, do not expect to earn dividends during the first few years of their existence. This condition does not apply to Independent telephone enterprises, however. These Independent telephone organizations, invariably, start with a list of subscribers in their localities fully equal to that which it has taken the Bell years to secure. They are then placed at once on the same advantageous basis occupied by the older competitive companies and are a source of profit to their owners practically as soon as they begin operations.

Upon the expiration of the Bell patents some eight years ago, there seems to have been an uprising all over the United States, in respect to the telephone business, and thousands of Independent telephone companies have since been organized in opposition to the Bell. The support accorded these Independent companies by the public has been astounding, and it is almost impossible to find an instance where a local Independent telephone company has not received the hearty and loyal support of the citizens in sections in which it sought to operate. The arbitrary methods employed by the Bell company and the lack of any local sentiment in its favor has made it comparatively easy for the Independent companies to work such a revolution in the telephone business as has never before been witnessed.

The Independent companies have invariably succeeded in securing the moral and financial support of the best citizens of their various localities. They have thus been able to easily finance their plans and through the support of a loyal constituency have easily secured a list of subscribers far in excess of the Bell.

In the United States there are practically, to-day, twice as many Independent subscribers as there are subscribers to the Bell system. In many localities in the state of New York the Independent companies have so far outnumbered the Bell that the comparison is almost beyond belief. Take, for example, the following towns, which are taken at random from a list of Independent exchanges in the western part of New York state; the numbers given for the Bell being estimated as nearly accurate as possible:

Town.	Independent.	Bell.
Hornellsville	1124	300
Salamanca	416	50
Friendship	250	4
Corning	913	300
Penn Yan	609	50
Canandaigua	454	100
Jamestown	2136	900
Sherman	365	1
Cortland	948	16
Waverly	1064	200
Geneva	685	100
Wellsville	325	150

In the organization of the Independent telephone systems, the organizers have felt that they were acting practically as trustees of the interest of the citizens of their respective localities by furnishing telephone service at reasonable rates. In turn, therefore, the people of the various localities feel that they are not only under a business obligation, but a moral one as well to loyally support the Independent organizations; they feel that they are partners with the Independent companies in reducing the cost of telephone service, and by patronizing and assisting these Independent companies, they are assuring themselves of a continuation of good service at reasonable prices with no possibility of returning to the old methods of restricted and poor service at high rates. As a result the Independent systems have grown enormously, as shown by the foregoing figures, as compared with the growth of the competing Bell company.

For the purpose of stifling the growth of the Independent systems, the Bell company early tried the experiment of buying up Independent systems; the most notable example of this kind being at Toledo some five years ago. An Independent telephone plant was started in that city with indifferent apparatus, but even with its crude operation it presented such tremendous competition that the Bell company felt compelled to purchase it. The Bell company, keeping the public in ignorance of its ownership, caused the plant to be operated so unsatisfactorily that it lost a large proportion of its subscribers. It pursued this policy for some little time and then, with a great flourish, announced that it had bought the Independent system. The citizens were indignant when these facts were made public, and, notwithstanding the discouragements presented, they immediately organized in that city another Independent system to which the business men subscribed $750,000, and the Independent company is being operated successfully to-day, with over six thousand subscribers.

In view of the unwillingness on the part of the public to leave the field exclusively in the hands of the Bell interests, the Bell company has abandoned the plan of trying to absorb local Independent companies, as in nearly every case where this has been done the citizens have indignantly resented it, and again organized new Independent companies. The local support given to Independent companies for this reason has been the most remarkable in the history of any business enterprise.

It is a sad commentary on the general business ability of our people to examine the history of thousands of commercial ventures that have failed. Hundreds of articles have been made (for which there has been no demand) after their ardent promoters have spent fortunes to produce them. Thousands of products have been made for which there would have been a demand had it been possible to manufacture them cheaply. They utterly failed to bring any returns to their owners because the price they were sold for left no profit to the maker.

We also have an enormous list of products that could be made cheaply and sold cheaply, but the sharp competition made them so difficult to sell that no profit was made. "No demand," "Out of style," "Too expensive," "Too much competition," has been the epitaph on thousands of graves of commercial enterprises.

The question may then be properly asked—is there any product for which there is a present demand and practically a sure future demand? Can it be furnished at a price where the public will buy it and leave a profit on the product? Will it go out of style? Will long credit have to be given on its sales? One may go over thousands of commercial propositions and be unable to find one product that fulfills all these requirements. It may be all right as to some desirable features, but fails in others. But when we come to the Independent telephone we strike an ideal product.

There is a demand for telephone service beyond the ability to supply it. The outlook for the future is more bright than at any time in the past. It can be furnished at a low price. It will bring attractive returns to its owners at a low price to the customer. Its patrons are the best class of people in their respective localities. The business is practically cash, and no allowance is necessary to provide for bad debts. The owners of Independent telephone organizations are entitled to and receive the most loyal support, morally and financially, of the localities in which they operate.

The history of hundreds and perhaps thousands of great industrial enterprises shows that the ability to make something cheap and sell it at a profit does not necessarily make a

successful business proposition. Bad debts have sent many a good business concern to destruction. The larger the concern the greater the danger from this cause. Aside from the telephone business, or the manufacturing, perhaps of some patented article, competition was never so fierce as to-day. It is at such times that a concern, having exhausted itself in its efforts to sell at a low price, enters the dangerous field of competition in giving credits.

Nothing is more demoralizing than credit competition. The capital of the concern is soon virtually invested in the business of its customers. The customer leans more and more heavily on the concern granting credit. They fear to offend and daily their position becomes more dangerous. A slight disarrangement of financial conditions arises, almost like lightning from a clear sky, and down goes the great concern to destruction. When times are at all bad the troubles from bad debts are tremendously accentuated.

The telephone business, fortunately, is not susceptible of any such vicissitudes. It has a list of subscribers whose bills are due monthly or quarterly. There is no credit given. No long notes are taken. The bills are promptly paid. They do not consist of large single items. While the bills aggregate a large amount they are distributed among the most reliable people of the community and in moderate single items.

The telephone business in its ability to collect for the service it renders is practically ideal. Its business is practically cash, and its resources are not tied up in accounts. Its net income is in the banks ready for distribution among its stockholders and bondholders. It is not standing on its books charged in large amounts against its customers. If the business of the world could be conducted as satisfactorily as the telephone business a most delightful financial revolution would be the result.

The enormous growth in the use of the telephones in the United States causes one to wonder if the future will see an equally large growth. All indications point to the conclusion that the future will see an ever-increasing use of the telephone in business and social intercourse, notwithstanding. Up to about five years ago, and previous to competition, the Bell company had installed, in the United States, in the neighborhood of nine hundred thousand telephones. Since the institution of competing telephone systems, however, business has taken a more rapid growth, and to-day the Independent telephone companies have in excess of two millions of telephones in operation, and the Bell company, throughout the United States, has about one million two hundred thousand.

Notwithstanding the tremendous growth, there is less than four per cent of the public in the United States to-day that is using telephone service. The demand for this service is growing yearly, and it will be but a short time when this percentage will be increased to something near the percentages in European countries, where from fifteen to twenty per cent of the population use telephone service.

There are so many arguments in favor of the benefits to be derived from telephone service, and so few reasons why individuals cannot have the use of this service that it is predicted that the telephone will soon be as generally in use as any household convenience. There are the same reasons for the household demanding telephone service that there are for modern appliances, such as hot and cold water, gas and other conveniences, that only a few years ago were unknown, but, at this time, are absolutely essential to the convenience of a home.

The necessities of the farmer having telephone connection with his nearby town are so great as to make it almost imperative that he be supplied with this service. The convenience afforded him in reaching his neighbors and his home markets by telephones are so great, and the expense of having this service so small, that it is predicted that all farmers who are endeavoring to handle their farming in a business-like manner will soon find the absolute necessity of being placed in close communication with his home markets.

Another important fact, as to permanency and future development, is that through the simplicity of operation of telephone systems the service can be given for so cheap a price as to bring it within the reach of the humblest of our citizens; and the future demand for telephone service can readily be appreciated when it is considered that a given sum of money invested in telephone service brings a greater return to the investor or subscriber than the same sum of money spent in any other way, or for any other article or commodity.

Over a large section of the country one is charged as much to send ten words by telegraph as would enable him to talk three minutes with the same party by telephone. The telephone is practically instantaneous, while the telegraph message may be delayed for hours. There can be no doubt about the future of the telephone. It would seem that every house, every place of business and every office containing modern conveniences will soon be provided with telephones as permanent fixtures.

In practically every other line of business the merchant and the manufacturer is compelled to change the style, quality, weight, shape and price of his goods from year to year, and even from season to season, to meet the competition of his neighbors, and to gratify the whims and fashions of the public. These changes require the expenditure of enormous sums of money, in new plans, in machinery, in new buildings and in hundreds of other ways. The telephone business presents no such conditions and requires no such expenditures of time and money to meet the wishes of the public.

The telephone exchange to-day, properly constructed, will last a generation, with but slight expense for renewal. Through its operation there is but slight wear and tear and deterioration, and the percentage of cost of operation and maintenance in relation to the gross income is less than that of any other public utility.

DEMOCRATIC NATIONAL CONVENTION WILL BE CONDUCTED BY TELEPHONE.

The Democratic National convention, which meets at the Coliseum in St. Louis on July 6, is to be conducted by telephone.

The committee on arrangements at its session at the Southern Hotel, reached the decision that telephones will connect each state delegation with all the other delegations and with the chairman's and clerks' desks. The state telephones are to be at the elbows of the leaders of state delegations, and a multitude of telephone girls will be at the switchboards to give instantaneous connections as called for.

It is expected in this way that much turmoil and confusion due to the chair's failure to hear a motion or to recognize speakers at exciting moments will be avoided, and that the general work of the convention will be facilitated.

In order to carry out the novel scheme, a private branch with a number system will be used. For instance, if the New York delegation wishes to speak to the Missouri delegation it will only be necessary to take off the receiver and call for Missouri's number. The same would apply to the speaker's stand or any other portion of the floor.

Each newspaper will have a telephone connected with state delegations, the chairman, the clerk, and the newspaper office. Long distance telephones will be in the vestibules.

Steel signs, securely fastened to the floor, will take the place of the old time wooden ones to mark state delegations. There will be accommodations for 300 working newspaper men, next to the platform, and at either end of the platform will be the telegraph wires.

A New Engineering Affiliation

Kempster B. Miller and Samuel G. McMeen have individually issued announcements calling the attention of the technical and legal public and of telephone people in particular to their entrance into general practice. It is understood that each will practice as consulting engineer, expert in patent causes and solicitor of patents, and that in the work

KEMPSTER B. MILLER.

of consulting engineering the two gentlemen will be associated.

We look upon this event as one of the most important in recent telephone history. The experience of each of the men has been broad and varied, and in many features the training of one will admirably supplement that of the other. Mr. Miller's telephone practice has been wholly with the Independent interests; Mr. McMeen's with the Bell companies and the Western Electric Company, a Bell concern.

Mr. Miller's name is familiar in both Independent and Bell circles, as that of the author of "American Telephone Practice," the recognized authoritative writing upon the subject. The man himself is widely known to be not only technically wholly capable, but energetic, fearless and frankly honest. His experience in the telephone and telegraph portion of the patent office has been of such a scope and character as to fit him to be of great value to his clients in all matters which have to do with patent soliciting, interference proceedings, and patent causes of other natures. Through his manufacturing connections Mr. Miller has designed much of the apparatus now used in the Independent field, and has had to do with the design of still more of it. His manufacturing experience has further developed and made apparent his marked talent for organization and management in general.

Mr. Miller was graduated from Cornell in 1893; he spent a short time as draughtsman and inspector of drawings in the Thomson-Houston Electric Company's works at Lynn, Mass., three years in the United States patent office, in charge of the class of telephony in the electrical division; with the Westinghouse Electric and Manufacturing Company; chief electrician of the Western Telephone Construction Company; with the International Correspondence Schools, preparing in that connection the textbooks on "Telephony" and "Telegraphy," and for the last four years with the Kellogg Switchboard and Supply Company. It may be said that Mr. Miller has been throughout his career a staunch and consistent advocate of Independent telephony, and that he stands for the success of the movement in a wholly unequivocal way.

Mr. McMeen's experience has been very general, although wholly within the field of telephony. After leaving Purdue University he took service with the Central Union Telephone Company, the Bell licensee, then operating in the states of Ohio, Indiana, Illinois and Iowa. This connection continued for seventeen years, and in that time Mr. McMeen

SAMUEL G. M'MEEN.

served in every technical capacity the field afforded. Ten years ago he became the company's assistant engineer; in 1896 chief engineer, continuing in that position until 1902. During these ten years were designed, engineered and put in operation all the principal modern equipments of the Bell companies.

In the Central Union company's territory in 1896 there

were no common battery equipments. In 1902 there were approximately sixty exchanges completely so equipped. Each of these was planned and executed by Mr. McMeen's forces, under his immediate direction. With the exception of ten or twelve of the largest exchanges, the Central Union company's common battery central office equipments were under his supervision in the company's shops, then in Chicago.

Following an early experience in fault location and cable repair, Mr. McMeen continued his connection with aerial and underground cable construction, and with the general activities of local and long distance line construction. His experiences in these directions have resulted in causing him to be recognized as one of the leading authorities upon the economics of construction and maintenance of telephone properties.

In his connection with the Western Electric Company since 1902 Mr. McMeen has been in charge of the central office equipment branch of the engineering department. Here are prepared the final and detail specifications for the manufacture of all the parts of the telephone exchange. This experience, coupled with his long previous labors in shop concerns, should have resulted in his understanding details and generalities of telephone exchange matters.

Mr. McMeen has lately returned from the City of Mexico, where he has been engaged for several months in a study of the telephone conditions. This study has resulted in his preparing complete plans and specifications for an extended and modern plant, including an underground conduit system, a cable plant, central office equipments, etc., to be constructed in Mexico's capital city. He reports the outlook in that region as most promising.

The *Electrical World and Engineer,* in commenting upon this new departure on the part of Messrs. McMeen & Miller, concludes by saying that such a move "is good for the business." It seems to TELEPHONY that such a move as this is particularly good for the telephone business, in which the best talent has for a long time been tied up either in the employ of the Bell company, or by manufacturing concerns in the Independent field. It is undoubtedly true that much of the engineering work for the Independent companies, particularly for those not large enough or strong enough to employ trained engineers, has been done by the engineers of the manufacturing concerns, and these were always open at least to the suspicion of "having an ax to grind." Prominent engineers, entirely untrammeled by the influence of any manufacturing company, have long been accessible in electric lighting, traction and other electric fields, but it was not until recently that such engineers appeared in the Independent telephone field. We are therefore heartily in accord with our esteemed contemporary's expressed opinion, and join in wishing the new firm every success.

It is common knowledge that the usefulness of the consulting engineers who are specializing upon electrical activities other than telephony is very great, and is enjoyed by the operating corporations and by the public, as well as by the engineers themselves. That this should be so of competent consulting engineers specializing upon telephony would seem to be even more likely, because the existing investment in telephony, already great, is now growing with remarkable steadiness, and by every indication of the times is destined to be one of the greatest of the industries.

TELEPHONY extends to the new affiliation the hand of fellowship, and prophesies that it will succeed. It is certain that a need for such talent exists in the Independent field, and it seems reasonable to suppose that with such a need the rewards will follow.

A tree destroyed by a telephone company in Springfield, Mass., was valued in the courts at $234.

EMPLOYES OF UNITED TELEPHONE AND TELEGRAPH COMPANY HONOR RETIRING CHIEF.

At its offices, 112 North Broad street, Philadelphia, the employes of the United Telephone & Telegraph Company, as well as the officers of the York State Telephone Company, the officers of the Eastern Electrical Construction Company and the officers of the Eastern Telephone Manufacturing Company, with whom he has held business relations, presented to the retiring general superintendent, J. W. Lattig, a handsome dinner set of 150 pieces and a beautiful cut-glass water set.

Mr. Lattig has been with the United Telephone & Telegraph Company for two and one-half years and during that time, as shown by the handsome gift, he has earned the good will and earnest co-operation of everybody from the officers of the company down. Mr. Houck, the traffic manager, made the presentation. His presentation speech was as follows:

"I am honored by having been chosen by our associates in the company to express to you the regret we feel at the severance of your official relations with us and to offer you a parting token of the high regard and esteem in which you are held, not only as our head official, but also as a man whom it has been good to know.

"I regard it as a privilege to have been associated with you, and I feel when I say this that I voice the sentiments of every official and employe of the company, from the office boy to the president, including those who have never had the pleasure of meeting you personally.

"You have proven yourself to be a man of high morals, kindly disposition, exceptional business ability, and with remarkable powers of endurance, and you have undoubtedly placed this young company upon a foundation which promises for it a bright future. In a sense we have reached the parting of the ways, but it is our hope that social, if not business, relations will bring us together many times.

"I now have the pleasure of presenting to you this dinner set, and we believe that this gift is in accord with your predominating characteristic in that it will be serviceable to others. If the future can hold for you all that we wish, your life will be full of happiness and success."

Mr. Lattig responded as follows:

"Gentlemen: This most generous surprise has taken me so unexpectedly that I cannot find words to express my gratitude. In fact, words can in no manner express my feeling. I wish to say that my success while with you has been due very largely to your loyal support, your good will and your hearty co-operation. I hope you will convey to all the employes my heartfelt affection. Gentlemen, you have simply taken my nerve away, and it is impossible for me to express my gratitude. Simply accept my thanks. I wish for you a future of happiness and success."

Mr. Lattig's resignation as general superintendent of this company went into effect April 1, when he began his new duties with the Delaware & Atlantic Telephone and Telegraph Company.

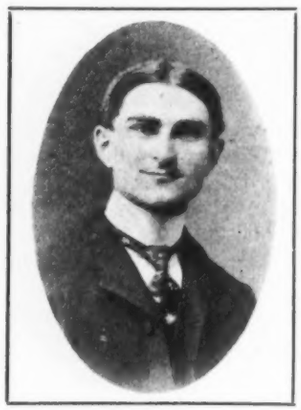
THE TELEPHONE IN POLITICS.

The telephone as an instrument of political reform is a new thing, but it is being so employed in Missouri. In that state telephones are suppled to farmers at the rate of one dollar a month. In some counties, where the farmers themselves have organized telephone companies, the cost is even less. As a result, the political machine, which for so many years dominated the state, has been unable to call snap primaries anywhere through county committees it controlled or to make the least headway in the usual sharp practices of the politicians. Whenever the orators for the machine begin a campaign in any county the farmers get busy at their telephones. They call township meetings and adopt their own resolutions and in a few days have the county as thoroughly organized as in former years the politicians had it organized for a general election.

The Mutual Telephone Company, Des Moines, Iowa, has voted to immediately begin the reconstruction of its entire system. The work completed will cost not less than $300,000.

The Voltmeter at The Exchange

F. C. Greenwald



The voltmeter is included in the equipment of most telephone exchanges. The uses of the instrument are many and important, although it is usual to find it employed in measuring the voltage of storage cells and nothing more. In some instances it is included in circuit on the testing table in order to make a few rough tests on lines.

The adaptability of the voltmeter is very little understood by the average wire chief.

It is my intention to discuss the various uses of the voltmeter in the following order:

1.—Methods used in making measurements of internal resistance of batteries and external resistances by means of fall of potential across the battery terminals; and the measuring resistance of external circuit by placing voltmeter in series and in multiple with unknown resistance while having known resistance in series with the unknown resistance.

2.—The use of the voltmeter on the testing table.

3.—Testing for electrolysis of underground lead cables.

The voltmeter is ordinarily used to ascertain the pressure or electromotive force obtained from a cell, or series of cells, when the given battery is on open circuit or discharging through a resistance comparatively great, compared with the internal resistance of the battery. This is done by placing the terminals of the voltmeter in contact with those of the cell, or other source of current to be measured. One terminal of the voltmeter is usually marked. This should be attached to the positive terminal of the cell, as shown in Fig. 1.

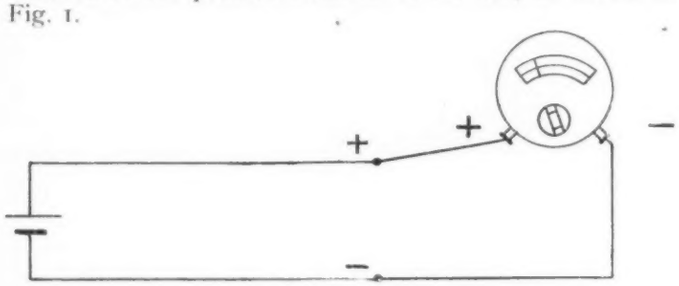


FIG. 1.

After arranging the circuit according to the figure the needle of the voltmeter will move along the scale and stop at a point indicating the pressure the battery is exerting and giving amount of pressure in units or parts of units of electrical pressure—the volt. If the needle on attaching voltmeter moves backward, it indicates that the wire attached to the terminal marked + is connected to the negative terminal of battery, and the wires on the voltmeter terminals should be reversed to obtain reading. By noting the forward or backward movement of the needle it may be ascertained which one of the two wires is positive and which negative, thus determining the direction of flow of current in the wires.

Simple measurement of the voltage of a cell on open circuit is not the limit of the application of the voltmeter. Experiment shows us if the cell be allowed to discharge through an ordinary resistance the voltage across the terminals of the battery will be less than that obtained when the cell is on open circuit. The difference between the two voltages is termed the fall of potential. Every source of current has what is called internal resistance. The internal resistance to the flow of current found in the battery must be added to the external resistance, in series with the battery, in working out Ohm's law. Internal resistances of batteries are usually small and do not seriously affect calculation. However, in the fall of potential method of measuring resistance the internal resistance of the source of current plays an important part; in fact, if there were no internal resistance of the current generator, the voltage as indicated by the instrument across the terminals, would remain constant, no matter how small the resistance through which the battery might be allowed to discharge. Figure 2 shows an arrangement of a battery discharging through a resistance, while the potentional across its terminals is being recorded.

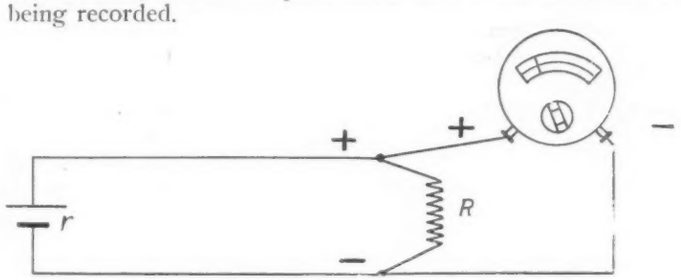


FIG. 2.

If the external resistance R is great compared with the internal resistance r, the difference between the pressure, indicated when the battery was on open circuit, and the pressure indicated when the battery is allowed to discharge, will be small. Should the resistance R be small, considering the internal resistance r, the difference in the readings or the fall of potential will be large. In fact, the relation of the outside resistance to the resistance inside the battery determines the difference in the potential across battery terminals when the battery is on open and then on closed circuit. The resistance of the voltmeter being extremely high as regards internal resistance, the circuit is here not considered as closed, when voltage is read with no other means of allowing discharge across the battery terminals.

Consideration of the foregoing, together with experiment, has yielded this formula:

$$V_2 = V_1 - Cr, \text{ or } r = \frac{V_1 - V_2}{C}$$

in which V_1 is the voltage obtained on open circuit; V_2 the voltage obtained on closed circuit, and C the amperage of the current flowing.

Considering Ohm's law, the above formula develops into this one:

$$r = \frac{(V_1 - V_2)\,R}{V_1}$$

R being the external resistance expressed in Ohm's law; $V_1 - V_2$ the difference between the voltage obtained on open and closed circuits, or the fall of potential.

The internal resistance of the battery is thus indicated as the result obtained by multiplying the fall of potential by the external resistance, and dividing by the voltage on open circuit.

Using this formula and knowing the resistance of the coil of wire or article constituting the external resistance through

which battery is discharging, it is possible to determine the internal resistance of a dry cell, storage battery, dynamo, etc.

Suppose with a dry cell we obtain voltage of 1.4 on open circuit, using the 0 to 3 volt scale of the voltmeter; on allowing the cell to discharge through 10 ohms the voltage drops to 1.24 volts. The internal resistance of the cell is

then $\frac{(1.4-1.24)\times 10}{1.4}$ or $\frac{16+10}{1.4}$ or 1.14 ohms.

Knowing now the internal resistance of the battery, suppose we wish to measure the resistance of a heat coil or magnet winding. Place the coil across the battery terminals, noting the fall of potential. The resistance of the coil

$$= \frac{\text{Voltage on open circuit} \times \text{Int. resist.}}{\text{Fall of Potential.}}$$

Suppose the fall of potential is 1 volt, the required resistance $= \frac{1.4 \times 1.14}{.1}$ or 15 + ohms.

We may perhaps wish to determine the amount of current flowing while the battery is discharging through a coil whose resistance may be either known or unknown. Let it be assumed, on connecting the coil across terminals of battery, that the fall of potential is .2 volts. The amperage may be ascertained thus: Int. resist. $= \frac{\text{Fall of potential.}}{C}$

or $C = \frac{\text{Fall of potential}}{\text{Internal R of battery}} = \frac{.2}{1.14} = .17$ amperes.

The fall of potential method is perhaps the best for determining the internal resistance of a cell, but may not be considered so in measuring resistance in general, on account of the fact that it is necessary to first determine the resistance of the battery used, thus necessitating two operations to obtain the result which would not do for very high resistance, as accuracy could not be obtained.

The following method is given as better for measuring ordinary resistance of from 10 to 1,200 ohms. It is advisable to have a battery of 15 volts at least. The unknown resistance, together with a known resistance, thought to be near the same resistance of that of the coil to be measured, and the battery are placed in series, as indicated in Fig. 3.

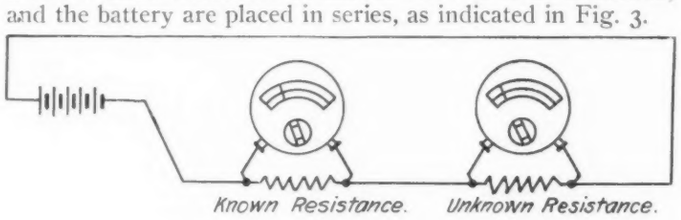


FIG. 3.

The voltmeter is first to be connected around the known resistance and the reading on scale noted, after which connect the voltmeter around the unknown resistance, again noting the reading. The resistances are directly proportional to the two readings obtained.

For instance, suppose we obtained a voltage of 12 around a known resistance of 200 ohms and a voltage of 10 around the unknown resistance. We then have the following proportion and equation available: $200 : X :: 12 : 10$ $X = \frac{10}{12} \times 200$. Unknown resistance = 166 ohms.

For measuring rather high resistance the following method might commend itself. In this method it is considered best to advise the use of a battery of 30 volts, more or less, if available, also a voltmeter having a scale reading from 0 to 150 volts. The 110-volt direct incandescent lamp circuit, in connection with the 150-volt scale instrument, is a good combination for the measurement of high resistances. It is necessary to know the resistance of the coil in the voltmeter. Makers of instruments usually mark the resistance of the voltmeter on the lid of the instrument. If the resistance of your instrument is not known perhaps someone in possession of a wheatstone bridge will determine this for you on request. In this method, the battery, voltmeter and the unknown resistance are placed in series, as in Fig. 4, after which the deflection on the scale is noted.

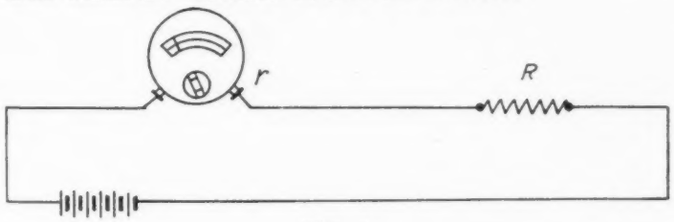


FIG. 4.

For example, let the following be assumed: We have a battery of 30 volts, and the resistance of the instrument is 2,500 ohms. We obtain a deflection of, say, 22 volts. To this arrangement of battery, voltmeter and resistance in series, the following formula will apply:

$$R = r\left(\frac{V_1}{V_2}\right) - r$$

in which R is the unknown resistance; r the resistance of voltmeter, V_1 the voltage of battery, V_2 the reading obtained with R in series with voltmeter and battery.

It is thus indicated that the unknown resistance would be determined by multiplying the resistance of the voltmeter by the voltage of the battery, dividing the result by the deflection obtained with unknown resistance in series, and subtracting the resistance of instrument from last result—thus:

$$R = \left(2500 \times \frac{30}{22}\right) - 2500 = 3409 - 2500 = 909 \text{ ohms.}$$

Good results could be obtained also by the use of an instrument having a scale reading from 0 to 3 volts, and using two dry cells in series, giving approximately 3 volts. The coil in such instruments usually measures about 500 ohms.

A voltmeter might be used, in absence of an ammeter, to determine the amount of current flowing in a circuit, by the use of the arrangement as indicated by Fig. 5.

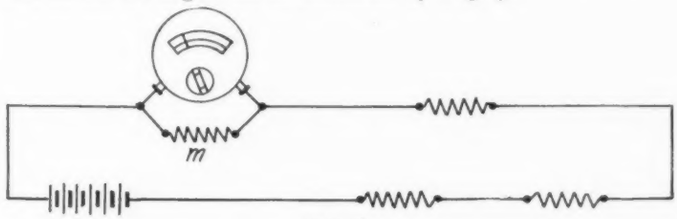


FIG. 5.

In this arrangement it is assumed that we know the resistance of a part of the circuit. Let M be the resistance known. The voltmeter is connected around this resistance and reading noted. Say the resistance is 25 ohms. Suppose we obtain a reading of 5 volts. The potential between two parts in a circuit is equal to the current flowing, multiplied by the resistance between the two points, or the current is equal to the voltage obtained, divided by the resistance, since $C = \frac{E}{R}$.

In this case we have this equation: $C = \frac{5}{25}$, which indicates that $\frac{1}{5}$ ampere is flowing in the circuit.

The most general use of the voltmeter about the exchange is in testing lines for crosses, grounds, etc., by use of some

arrangement of battery, voltmeter and line to be tested, all in series.

Fig. 6 gives such an arrangement. This consists of battery, say, of 50 volt strength and 4 six-point keys. Keys No. 3 and 4 are placed in circuit for talking and ringing purposes, respectively, and have nothing to do with the voltmeter circuit. The sketch indicates that when the test plug, or other means of attachment, is connected to the line to be measured, the voltmeter and battery will be in series and across the line metallic, thus indicating on the scale whether or not the line is crossed, and, if so, to what extent—high or low, swinging or slowly varying resistance.

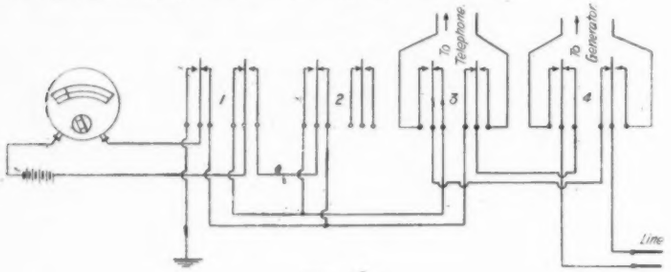


FIG. 6.

Throwing key No. 1 grounds one side of the arrangement of battery and voltmeter in series, and places the other side to one side of the line; thus giving an approximate indication of the insulation against the ground on the given side of the line. Throwing key No. 2 simply puts the other side of the line tested against the free side of the battery, voltmeter circuit.

Arrangement for testing for "short" on line commends itself for the following reasons, both in central energy exchanges and those using local battery. In the central energy plant condensers at subscribers' station frequently go "short," allowing the battery to flow out over the line, through defective condenser and ringer coils, thus operating the line relay, throwing signal on line, besides wasting the battery. This condition would be indicated on test by the voltmeter showing a reading of, say, 40 volts—using 50-volt test battery—if the ringer movements were around to 1,000 ohms resistance.

If the line wires were crossed the resistance of cross very likely would be much less than 1,000 ohms, giving a higher reading on scale of instrument. If swinging cross, the needle would kick from perhaps 0 to near maximum reading, indicating the character of the trouble.

Suppose the inside wiring of the sub-station is wet or damp, or we have a case of moisture in the cable, the needle would, perhaps, deflect to 40 volts and gradually sink to, say, 5 to 10 volts, showing that the insulation resistance between the two wires is extremely low, and giving an idea of the drying out effect produced by the rather high potential test current.

In the magneto exchange we, of course, would not expect a perfect line to measure open, as the ringer coils at subscriber's instrument would cause the voltmeter to show a deflection. A little practice usually gives the operator of the test circuit an idea as to whether the deflection noticed is due to the resistance of the ringers or is caused on account of trouble on the line. This is especially so in the use of a voltmeter, reading to but 3 volts, the coil of which would probably measure 500 ohms, more or less. In this case a perfect line would very likely give a deflection of about 1 volt, if ringer movements are of 1,200 ohms resistance, as is often the case with bridging instruments. In case no deflection is noticed, it is at once indicated that the line is open. Loose connection would be shown by the needle of the instrument going to the measurement usually obtained when the ringers are across the line, and then falling to open measurement or to a point indicating high resistance.

It is sometimes difficult with other methods of test to ascertain whether the trouble is caused by swinging cross, loose connection, induction or ground on line. If the trouble is caused by ground on one or the other side, the ground can readily be detected by arranging circuit to throw battery out on one or the other side to ground. In the central energy plant, on account of the condenser making the line open as far as the direct test current is concerned, the side of line grounded will at once be determined. In the magneto system, however, on account of the ringer movement being across the line, should one side be grounded, a reading will be obtained indicating that both sides are grounded. In order to ascertain the side grounded, in the latter instance it would be necessary to open the line at sub-station, preferably at instrument posts, so as to leave the arrester at the house included in the line tested. Arresters, naturally, frequently are the cause of lines being grounded. This would show whether both sides were grounded or the reading for both sides was due to short on lines due to ringer coils.

It should be considered in testing lines that grounds on both sides of the lines will allow of a short reading being obtained; also a short or cross on line, if one side is grounded, will indicate both sides as being grounded. A cross in the line, not due to the ringers, will have the same effect as that produced by the ringers across line, in regard to the ground reading.

There is some discussion as to whether it is best to use battery of low voltage or high voltage in testing lines from the table. There are advocates of both methods. Those in favor of high voltage battery, in connection with high reading voltmeter, argue to the point—a better idea as to insulation resistance is obtained with the use of 50 volts, as compared with results obtained employing 3 volts in connection with low scale instrument. The other side maintains that the variation in line resistance is more noticeable with the low voltage and the low resistance instrument.

It is a good plan when purchasing instrument to obtain, if possible, a voltmeter having two scales, reading from 0 to 3 volts and from 0 to 150 volts, or one reading from 0 to 15 volts and 0 to 150 volts. Most up-to-date exchanges have portable instruments of this type, thus enabling the wire chief to use either scale, or one following the other, when considered advisable, allowing him the advantages offered by either or both voltages. By both the wire chief and inspector becoming familiar with the various readings noted in the use of the voltmeter, usually a comparatively intelligent idea as to the character of the trouble sought is obtained.

The inspector after some little experience can with remarkable facility go almost direct to the cause of the 30-volt short or 50-volt one side ground he is sent to clear. The wire chief in a central energy plant, on obtaining a 50-volt short, would direct the inspector to look perhaps for a receiver off hook; on obtaining a 42-volt short he would very likely be moved to give the inspector a condenser to replace one he thinks has gone short on the line under test. Other ideas similar to these suggest themselves in practice

One cause of anxiety to those in charge of large underground cable systems is due to the peculiar action of electrical current in passing from the cable sheathings through the ground to some neighboring metallic object; producing, on account of the oxygen liberated and because of the presence of different chemicals in the earth, an oxidation or detrication of the lead forming the sheathing. A current flowing from some object through the earth to the sheathing is not considered as productive of damage. For the sake of protection it is advisable to ascertain whether there is any current flowing—that is, any difference of potential between neighboring electrical car rails, gas or water pipes, etc., and the sheathing, and if so, to ascertain the direction of flow. If the current flows from the pipe or some other object near

the sheathing at the manhole to the sheathing no harm can be done on account of electrolysis, but if current is found to be passing from the sheathing to a neighboring object some means of protection should be applied.

It is usual after determining whether there is a dangerous flow of current from the sheathing to a car rail or pipe, to run a heavy wire or copper strap from the sheathing to the object, thus allowing the current to take a path of low resistance from the lead in the casing to the object, and not, as before, leaving the casing and going through the ground, practically forcing a combination of the lead in casing with the chemical compounds in the earth. The usual means of determining flow of current, as well as the direction of same, is to proceed as follows:

Two steel pointed rods are used to form good connections to the cable sheathing and the objects near by. By means of wires attached these sharp pointed rods form the terminals of a portable voltmeter having a scale reading preferably to three volts, and not over five volts.

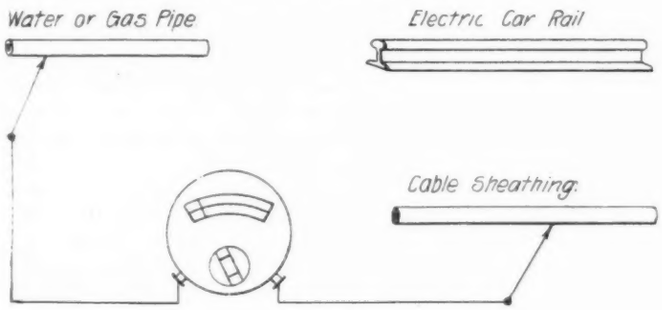


FIG. 7.

On setting up this arrangement, as in Figure 7, should there be a difference of potential the needle of voltmeter will kick either in one direction or the other. If necessary, reverse the positions of the rods so as to allow voltmeter to take the reading. After noting the reading notice whether the wire, attached to positive terminal of instrument (marked +) goes to the rod in electrical connection with the rail or pipe, or to the rod connecting with the sheathing. If the terminal marked + should be in connection with the sheathing when reading is obtained, it indicates that there is current flowing from the sheathing to the rail, etc. Reading should be noted. Should, however, the + terminal be attached to the rail or pipe reading can be disregarded, as this indicates that the current is flowing in the wrong direction to affect the sheathing.

Readings such as the preceding should be taken at all manholes. If readings obtained are at all large and in the direction apt to cause detrication, the cable and the neighboring source of the disturbing current should be bonded together. If readings are small at successive manholes it might be considered necessary to place bond only at the maximum danger point, indicated as the point where the highest reading was obtained.

Readings for detection of causes of electrolysis should be frequently taken at all manholes, as changes in construction of trolley lines, gas or water pipe systems are likely to produce new points of difference of potential, which should be given the same attention as those previously brought to light.

SEEING BY TELEPHONE.

Various methods have been proposed from time to time for transmitting sight electrically, but they seem to lack certain necessary features. A system has been devised by M. A. Nisco, however, which seems to have some practical features. A sensitive screen is prepared by coating a metallic net with some insulating gum. Into the meshes of this net copper wires are inserted before the insulation hardens. After drying the surface is dressed off with a file and is then coated with selenium, thus forming a sensitive connection between the wires and the net. The screen prepared in this way is treated to crystallize the selenium, so as to bring it into the proper sensitive condition. The copper wires which terminate in the screen are then led into an ebonite cylinder, and pass out through holes corresponding in position to their termination in the sensitive screen. These holes are arranged in spirals in such a way that a metallic blade which revolves around the cylinder successively makes contact with every terminal. The blade is revolved about the cylinder at a speed of 600 revolutions per minute, so that every contact is repeated ten times a second. From the blade and from the wire net of the sensitive screen wires are led through a battery and to a telephone receiver.

If a picture be thrown upon the sensitive screen and the blade be revolved about the cylinder a varying current will be sent through the telephone, the intensity of which will vary with each contact, according to the intensity of the light falling upon the corresponding section of the screen. This telephone by means of a sensitive carbon microphone repeats through the transmission line the current variations produced by the apparatus just described. At the receiving station a second telephone repeats the variations in current through a second microphone in a local circuit arranged to produce a spark. The intensity of the spark at any instant corresponds to the intensity of illumination of a particular part of the selenium screen. This spark-gap is placed within a cylinder having spiral slots, and the slotted cylinder revolves in synchronism with the contact blade at the transmitting station. This arrangement throws the light of each spark on such a part of a receiving screen so as to produce an illuminated image similar to that thrown on the sensitive receiving screen. The method can only produce variations in illumination. It requires two wires, one for synchronizing the moving parts, and one for transmitting the varying current.

NEW PITTSBURG & ALLEGHENY CONNECTIONS.

The lines of the Pittsburg & Allegheny Telephone Company will soon be connected up clear through from Pittsburg to Baltimore and Philadelphia. This will be accomplished by direct connection with Johnstown, Somerset, Cumberland, Hagerstown and thus straight through to Baltimore. The Johnstown connection is over the new Johnstown & Pittsburg Telephone Company's lines. From there Somerset and Cumberland are easy of access. At Cumberberland a connection is made with the lines of the Maryland telephone people. The line from Baltimore to Cumberland is already completed with the exception of about eight miles which will be disposed of at once. Workmen are now putting up poles and stringing wires for the Johnstown-Pittsburg line and it is all expected to be finished in the early spring. A solid standard pole line will extend from Pittsburg to Baltimore upon which heavy copper wires will be strung as soon as possible. From Baltimore to Philadelphia the lines radiate to York, Harrisburg, Atlantic City, Camden, West Chester, Wilmington and nearly all of the smaller towns of the vicinity, so that the completion of the line means the opening up of a vast new territory for the Pittsburg & Allegheny system. The completion of this eastern route will form one of the eastern connections for the big Independent system from Philadelphia to Kansas City. The connection to the east, which will be furnished by the Pittsburg & Allegheny and the Johnstown-Pittsburg will not only be by the southern route to Cumberland, Hagerstown and Baltimore, but by a northern as well, the lines connecting with those of the United and Keystone systems, strong Independent companies which operate in the central and eastern part of the state.

Telephone Lines—Cables

SAMUEL G. McMEEN

The practical man in the telephone business wants practical notes on ways of doing things, although his only quarrel with a theoretical treatment of any subject is because it so frequently ends the discussion without reducing the theoretical to a practical statement which would be to him of any value. This discussion of telephone lines is intended to deal in theory so far as it is of advantage in reaching a practical conclusion, and the reasons for introducing other than practical features will be pointed out.

So far as present physical knowledge goes, the requirements which a telephone line must fulfill in a greater or less degree are these: Low resistance, low capacity, low impedance, high insulation.

The reason for low resistance is too obvious to be discussed. The reason for low capacity is nearly so, but may be discussed briefly with some advantage.

Any capacity which a telephone line may have, if the line is a metallic circuit, is effective wholly to the detriment of the usefulness of that line. Whether the line be above the earth or in the earth the capacity of each wire for the earth and each wire for the other, results in giving a capacity across the pair quite as if an actual condenser were connected across the circuit. Indeed, a telephone line of whatever length is effectively a condenser, the surface of its two wires being the plates, and an intervening insulation, whatever it may be, being the dielectric. And as a condenser is of greater or less capacity, depending upon the size of its plates, their closeness together and the character of the separating material, so the telephone line will have a greater capacity as the surface of its wires is larger, as the separation between its wires is greater and as the material between the wires has greater specific inductive capacity.

Relative to other insulating materials, air has the lowest specific inductive capacity. With wires strung in the air, also, it is convenient and of advantage to have the conductors of a pair separated by a foot or so; it is ordinarily best to have aerial wires at least twenty feet above the earth. All these reasons act to limit the capacity. Taking any aerial line as an example, the capacity of the two wires for each other would be increased by increasing their surface without changing the amount of metal; by separating them with any solid insulating substance rather than by air, and by decreasing their distance apart or their distance from the earth.

When the space to be occupied by wires, as well as other requirements, demand that they shall be placed in cables to be hung in the air or placed in the earth, it is no longer feasible to insulate them by means of air alone. After many experiences with other materials the wires of telephone cables are now insulated by covering them with the solid material which most nearly approaches air in its specific inductive capacity; that is, dry paper, the pores of which are filled with air.

High insulation and low impedance are manifestly important requirements and demand no extended discussion. High insulation is essential in order that the currents which should be confined to the line may not leave, and that currents which should be kept from the line may not enter it. Low impedance is essential in order that currents required to pass over the line may do so without dissipating themselves in useless work.

If it were not for the short-circuiting effect of the capacity between the wires of a telephone line it would be possible without an excessive investment in copper to have a line of any length which might be required. The obstacle offered by the capacity, however, is great enough, so that lines in the air suffer from it to a degree sufficient to limit them in their practical length for speech transmission. Lines in cables suffer from it to a much greater degree, because the wires of a pair must be so much closer together, and because the insulating material, even if of dry paper, increases the capacity.

The problem of eliminating the capacity between the wires of a line has been the subject of much study and investigation and has resulted in the inventions of Dr. M. I. Pupin. He counteracts the hurtful effects of the capacity by inserting impedances in series with the two wires of the line. So far as any application of his invention has been made the method has been to insert impedance coils at points separated by predetermined intervals. The relief is real and a considerable gain is accomplished. Many aerial long distance lines have been equipped with impedance coils, ordinarily known as "loading coils," and underground cables of small wires have had the same remedy applied with marked benefit. An interest in this phase of engineering may be further gratified by a reading of the patents granted to Dr. Pupin, of which there are two, the date and numbers being June 19, 1900, Nos. 652,530 and 652,531.

It will be observed that in this cure for the hurtful effect of the capacity, the method is that of inserting impedances at fixed points to counteract the capacity, which is distributed throughout the line. It is very evident that the ideal method of cure is to distribute the impedance uniformly through the conductor, thus enabling it best to cure the capacity which is distributed along the conductors. The reason this better way is not practiced is because no one has shown just how it shall be done.

Aerial and underground telephone cables of the best type should be formed of wires of soft copper, not necessarily larger than No. 18 B. & S. gauge and not permissibly smaller than No. 22 B. & S. gauge. Each wire should be covered with at least one wrapping of dry paper, the wrapping of the two wires of each pair being of different colors. The wires of a pair should have a twist approximately once in three inches, and these twisted pairs should be laid up in layers to form a round cable. It is of convenience to have the total number of pairs in a cable subdivided by tying up some predetermined fraction of the total number in a bunch, again tying the succeeding fractions as they are laid over this bunch in layers. The only advantage of doing so is to facilitate splicing, terminating and testing.

The core of insulated, twisted and laid-up wires should be protected by paper, cotton yarn or other binding material and then covered by a lead sheath formed upon the core in a continuous length for the piece. The thickness of the lead may be less for aerial than for underground work. When applied the ends of the sheath should be closed by lead caps soldered on.

In erecting or laying lead-covered cable the requirement of greatest importance and which must be impressed upon all workmen is that the sheath must be kept intact, as the efficiency of such cable depends very greatly upon the insulation, and this is dependent upon every trace of moisture being kept out of the core. A hole in the sheath so small as to escape ordinary detection will admit moisture and in sufficient quantities to lower the insulation of the cable to a point where repairs must be made. Care in erecting and

handling cable, therefore, is the surest and safest investment which may be made to protect lines so distributed. The rule of action, therefore, may be so formulated:

Expose the cable core as little and for as short a time as possible, always soldering up an opening in the lead sheath or the end of the cable when cut, and as quickly as possible.

Tape wrappings over ends or openings is the merest expedient and should not be depended upon.

SELF-DRYING JOINTS AND TERMINALS.

In splicing and terminating lead-covered cables, described in detail hereafter, care in protecting the core from moisture is well repaid. Even the moisture of the air in ordinary weather and that of the hands in jointing the conductors lowers the insulation. If no other means is practiced the moisture from these sources must be boiled out of the core as a last step before closing a splice or terminal. In some cases, particularly those of cables terminated in iron heads, occasional access to the cable core is of advantage. An instance of such a case is that of terminating a 60-pair cable in a 60-pair iron terminal on a pole and at a future time wishing to branch thirty pairs from this terminal to another point. This may be done, but to do it requires opening the terminal, and there is no ready means of boiling out any moisture which may have entered the core during the time the terminal was open. Neither is it convenient in so terminating the cable to leave the head filled with paraffin, because this filling will be in the way when an extension, as indicated, is to be made.

A convenient escape from these difficulties is found in the use of some material within the terminal which will continuously absorb moisture and having so absorbed it will keep the insulation in that part of the cable high. There are many such absorbents, most of them possessing corrosive and other disadvantages. A material which is found satisfactory is simple unslaked lime.

To use lime as a means of raising and maintaining insulation in cable terminals, lumps of convenient size are selected and distributed through the mass of paper-insulated wires. For the sake of neatness the lumps may be wrapped in cheese cloth or porous paper, but there is no objection to their being supported among and by the wires themselves. Tests upon cables so terminated and upon which no effort to boil the moisture out of the ends has been made, have shown that the insulation per piece of fifty megohms has risen to 1,500 megohms or more and that this insulation has remained high.

The ability of lime to absorb moisture may be utilized with advantage in cable splices, among the wires of which lime may be distributed before drawing over and wiping on the sleeve. A cable with spliced terminals so treated may be found to be of relatively low insulation immediately after jointing and terminating, but the insulation will rise steadily and after a few days will be found as high as if the cable were in a continuous length with no splice and as if had not been exposed to the air at all since its manufacture.

CENTRAL OFFICE ENDS.

There are three ways in which lead-covered cables may be terminated at the central office. A convenient, and the uniform early method, was the use of box terminals of iron or other material. If such terminals are hermetically sealed they comply with the necessary conditions of good practice, but they have been found to be bulky and expensive. They possess the distinct advantage of allowing access to the wires for rearrangement in the case of the failure of any, and for extending branches if they should be found necessary.

A later and now widely used method is that of the flexible terminal, known colloquially as the "pothead." A pothead is simply a thoroughly sealed splice between the paper covered wires of the cable and the rubber covered wires, extending therefrom without a lead sheath. Details as to the best method of making such terminals are given later in this series. The advantages of the method are its compactness, original lower cost than previous methods, and its complete sealing of the core of the cable against entrance of moisture. The latter is true only when the work has been thoroughly well done, and for that reason extreme care must be exercised, particularly when potheads are made under unfavorable conditions out of doors. The disadvantages of the flexible terminals are inaccessibility of the wires once a splice has been made, and the occasional failure of the seal, due to accident or careless making.

The third method of terminating is a simple one and has been placed in extensive use. It is that of splicing to the end of the paper-insulated cable a length of similar cable differing in that the wires are insulated with wool instead of with paper. The splice is made in the usual manner and is described later, being filled with paraffin or cable-sealing compound. The reason for such a method is that wires covered with wool maintain a relatively high insulation even when exposed to the air. Such insulation will not withstand very damp air, so that the method is distinctly more suitable for the terminations of office ends of cables than for terminating upon distributing poles.

A choice between one or the other of the three methods can easily be made by counting the cost in a given circumstance and weighing this against the advantages and disadvantages of either method in the conditions to be met.

LONG DISTANCE TELEPHONES FOR RAILROADS

The New York Central and Lake Shore railroads at a great expense will install an independent telegraph and telephone service extending from New York to Chicago. It will include a trunk line direct wire which will follow the West Shore tracks from Weehawken north, with a loop running into the Grand Central station, and pass through the principal cities as far as Buffalo. West of Buffalo the line will follow the Lake Shore and terminate at the Lake Shore station in Chicago. It is expected that the line will be in operation this month.

The Illinois Central railroad is also rapidly perfecting a system of telephone communication between stations on all of its lines. So far, on the Chicago-St. Louis division, the innovation has been extended as far south as Clinton.

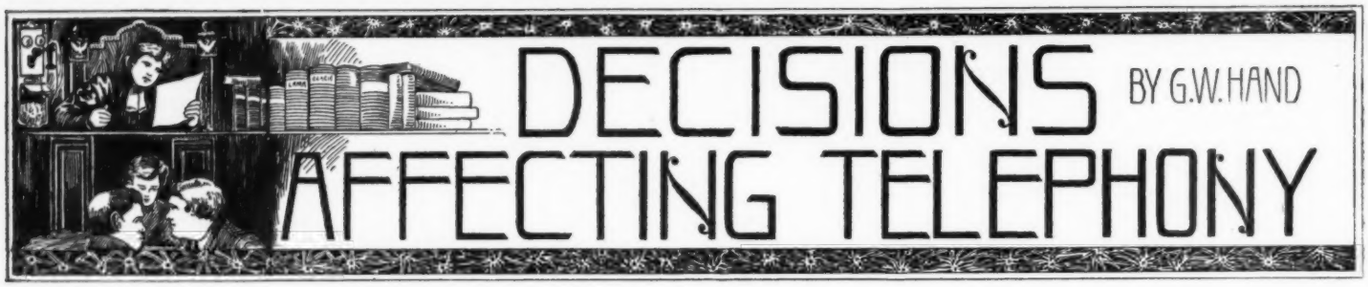
Work has been begun on the task of bringing the telephone line on to Springfield, Ill., and it is expected that this will be done by the middle of summer. As soon as that city is reached the line will be further extended to St. Louis.

The Ironton Railroad in Pennsylvania will do away with the telegraph system along its lines and the Lehigh Telephone Company will install the telephone system.

The purpose of the railroad telephone service is to relieve the telegraph wires and to put the division and other important offices of the road in more prompt connection with the general offices. At the present time important business must take its turn with other telegraph matter and often serious inconvenience results.

Should a breakdown occur anywhere on the road the intelligence can be communicated by making connections with the telephone apparatus and the overhead wires which parallel the track. The necessity of reaching a telegraph station and finding an operator is thus obviated and the saving of time and lives, perhaps, becomes very great.

A Connecticut telephone inspector found the operator at "central" asleep the other night with over 100 calls registered. This happening is telegraphed all over the country as if it were news, but we know habitual telephone users who claim that the operators on their line are asleep both day and night.—*Ex.*



MOVER MUST PAY FOR DAMAGE TO TELEPHONE WIRES.

A DECISION which will meet with a good deal of satisfaction among the telephone companies of North Dakota was recently given by the Supreme Court of the state in the suit of the Northwestern Telephone Company to recover damages from E. B. Anderson, a building mover of Grand Forks, who caused injury to the company's wires by cutting them to make way for a large hotel, which the city authorities had given him permission to move through the streets. Anderson claimed that as he had the city's authority to move the building he was not liable for any injury occasioned by necessary cutting of telephone wires to make room for it to be taken through the streets. The case was tried in the District Court several months ago and a verdict awarded the company for $268.70. The report of the trial will be found in the November, 1903, TELEPHONY. The Supreme Court has affirmed the decision. Hereafter telephone companies may proceed against building movers with the assurance that they have the law on their side in asking recompense for interference of this nature. "The use of a street for the moving of houses," said Judge Morgan, who wrote the opinion, "is an extraordinary use thereof. Such use may be permitted, but cannot be legally done in destruction or impairment of vested rights" The court further said that there was no intention on the part of the city to grant any authority to injure the company's property.

Northwestern Telephone Exchange Company v. Anderson. Decided February 19, 1904.

WHEN LICENSE FEES ARE LEGAL.

Along with the recent decisions in the eastern states concerning the right of municipalities to levy license fees on telephone companies, the case of the Sunset Telephone & Telegraph Company, decided a little over two years ago in the United States Circuit Court of Oregon, is in point. A provision of the charter of the city of Medford, Oregon, said that the city should have the power to license, regulate or prohibit telephone and telegraph companies from using the roads, streets or alleys of the city, and to fix the compensation which such companies shall pay the city for the license or privilege. Under this authority the city passed an ordinance imposing upon the company a license fee of $100 per annum. The facts were about the same as those under which the suits in the eastern states were brought. If the word license meant that the city council had authority to collect any amount which it might levy, then the company could be compelled to pay; if the law giving the authority contemplated that the city should levy a tax sufficient to cover the expense of inspection, then the company could contest the reasonableness of the tax. "The power to license implies the power to charge a fee therefor sufficient to defray the expense of issuing the license and to compensate the city for any expense incurred in maintaining the regulation." This was the language of the Federal Court in 22 Fed. 701, and the case above cited was disposed of along the same line of reasoning. The court said that $100 was grossly in excess of the actual expense and declared the tax illegal. This important ruling of the Federal courts is good law and companies may therefore successfully resist the payment of license fees if out of proportion to the expense incurred in inspecting their properties.

Sunset Telephone & Telegraph Company v. City of Medford et al., 115 Fed. 202.

MEASURE OF DAMAGES FOR INJURY TO SHADE TREES IN IOWA.

A recent case in the Iowa courts lays down the rule of law on this question in this jurisdiction. One Meyer sued the Standard Telephone Company for injuring his shade trees. The company answered that it had the right to use the highways in front of Meyer's property and that it was not liable unless it did greater injury than the circumstances required. It alleged that it had done no unnecessary injury to his trees and denied any liability. In the lower court Meyer had a verdict for the full amount of the injury. The company carried the case to the Supreme Court and there secured a reversal of the judgment. This court said that the measure of damages in this state is the difference between the value of the land as it would have been if the cutting had been reasonable, and what it was after the cutting, not the difference between the value of the land before and after the cutting. If there is no unreasonable cutting, then the property owner can recover nothing under this rule. The great majority of the states hold to the rule that a company must pay for all damage done. To the writer's knowledge, the only other jurisdiction in which the Iowa rule has been declared is in the Fifth Circuit by the United States Circuit Court of Appeals, in the case of the Southern Bell Telephone & Telegraph Company v. Constantine (61 Fed. 61).

Meyer v. Standard Telephone Company, Supreme Court of Iowa. Decided January 30, 1904.

SALE OF FRANCHISE DID NOT VEST ANY RIGHTS IN BUYER.

This was decided by the United States District Court for the District of Indiana recently in the case of the Cumberland Telephone & Telegraph Company v. City of Evansville. The company brought the suit to enjoin the city from carrying out the provisions of the ordinance passed August 18, 1902, declaring that the company had no authority to do business within the city, and ordering the company to remove its poles and wires from the streets. December 11, 1882, the Evansville Telephone Exchange secured from the common council of the city a franchise giving it authority to do business therein. Under this franchise the plant was erected. June 30, 1883, the Cumberland Telephone & Telegraph Company purchased the property, including the permission given by the council to the former company to do business within the city. The latter company had operated under this franchise continuously up to the time of the suit. In answer to the bill for the injunction the city said that the complainant company had never entered into any contract with it, and that no franchise had ever been given complainant to operate in the city. There was no provision for a sale of the franchise in the original ordinance and the United States court, finding no implied authority,

held that the purchaser obtained no rights from the sale. Had there been a power of sale the decision would have been different.

Cumberland Telephone & Telegraph Co. v. City of Evansville, 127 Fed. 187.

BELL COMPANY TRYS TO DESTROY COMPETITION BY AID OF THE INJUNCTION.

In October, 1903, the Central Union Telephone Company, operating in Moline, Illinois, secured an injunction temporarily preventing the Electric Union Telephone Company, an Independent, from using that part of the telephone line or doing any further building between South Rock Island and Milan, on the allegation that the former company had the exclusive right of way between the two places. On the affidavit the injunction was granted and the rights of the Independent company brought in question. The controversy arose entirely by the action of the Bell interests seeking to get exclusive control of the right to operate lines between the places. The argument on the part of the defendant was that the granting of the exclusive rights, which it claimed the other company did not have, was against public policy and void, and on the showing made the injunction was dissolved. As a result of the decision the Electric Union Telephone Company will proceed to connect with various urban lines and generally increase the telephone facilities at Milan and Rock Island.

Central Union Telephone Co. v. Electric Union Telephone Co. Injunction dissolved February 24, 1904.

COMPANY MUST MOVE WIRES.

Townsend, Reed & Co., a traction company operating in Lebanon, Indiana, found it necessary to move certain wires of the Long Distance Telephone Company in order to erect its trolley wires, and was met with an injunction by the telephone company, preventing the interference. The hearing on the injunction recently came up in the circuit court, where it was held that the traction company would not have the authority to change the wires itself, though it could compel the telephone company to make any necessary changes, and that whatever expense the telephone company incurred in making changes to meet the requirements of the traction company were to be paid by the latter company. Each corporation is a public utility, doing business under municipal franchise, and may require the other to adjust itself to allow the ordinary development, and the changes found necessary by the other, but in any case compensation may be required from the one put to trouble.

TELEPHONE COMPANY RECOVERED INSURANCE.

February 6, 1902, the Wausau Telephone Company of Webb County, Wisconsin, sustained a loss by fire caused by the crossing of electric light and telephone wires. The company carried something over two thousand dollars of insurance, distributed among the following companies: The United Fireman's Insurance Company of Philadelphia, the German-American of New York, the Lumberman's of Philadelphia, and a London, England, company. Each of these companies had a provision in its contract of insurance as follows: "This instrument does not cover any loss or damage to property caused by electric currents, whether artificial or natural." The insurance adjuster came on, and after finding that the fire was caused in the above way, he refused to settle for the damage done, claiming that the above provision of the contract of insurance exempted the companies from any liability. The telephone company thereupon brought suit against the insurance companies in the circuit court for Webb county, contending: (1) that the clause referred to damage other than loss by fire or what is designated in courts as direct damages, such as shattering or damaging or other injuries not resulting in fire losses; (2) if it was construed to mean fire loss it would be a violation of the statute of Wisconsin prescribing a standard policy of fire insurance. The construction given the clause by the telephone company was accepted by the court and a judgment for the amount of the damage given.

GUARANTY FUND DECLARED FORFEITED.

The city of Detroit, early in 1901, brought suit against the People's Telephone Company to recover a sum which the city claimed was due it for inspecting the company's plant within the city. The company did not deny this claim, but as a set-off to it made a demand for the return of a $5,000 guaranty fund which it had deposited with the city. The conditions under which this fund was to be returned to the company were that the company was to have the plant constructed within a certain time, with 3,500 subscribers on its list, and to be in full operation within fifteen months after July 1, 1901. The company had fulfilled all of the conditions, save the last, at the time the suit was brought. The city contended that the company having failed to comply with this provision could not get back the deposit. The company argued that in no case could the fund be all retained; that the city was lawfully entitled only to so much of it as it could prove as damages growing out of breach of the condition. At the trial the city offered no evidence to show actual damages as a result of the company not being in full operation within the stated period. The Supreme Court, to which the case was carried from the Detroit courts, said that the answer to the question depended entirely whether the fund should be considered "liquidated damages" or a "penalty." By the first is meant that the parties have estimated the damages beforehand and the sum named is to be recovered at all events; by the latter the sum named is a provision to insure the performance of the contract and in case of breach, if grossly in excess of the damages, will be returned in part. If the damages can be estimated, even if the parties have declared the sum in plain words to be liquidated damages, it will be considered by the courts a penalty; if uncertain, liquidated damages. It was decided that the damages in this case being public, were so uncertain as to bring the fund within the class termed liquidated damages, and that the company could not get back the deposit. It is not unlikely that courts generally would rule in the same way on the question of the return of deposits of this character.

City of Detroit v. People's Telephone Company, 10 D. L. N. 935. In Supreme Court, decided March 8, 1904.

VICTORY FOR INDEPENDENT INTERESTS.

April 2, Probate Judge Nippert of Cincinnati decided that Independent telephone companies have the statutory right to occupy the streets of the city and that the demand of the city solicitor that these companies be required to state the exact location of every pole and wire, the kind of wires and equipment they proposed to install and other burdensome conditions as a provision of entrance, was unreasonable. He said that all the court could do was to decide "the manner in which the companies shall occupy the streets." If sustained in the higher courts, the decision cannot fail to have a wide influence throughout the state.

The farmers down in Washington county are enjoying free concerts over the telephone lines. One farmer purchased a large phonograph and an excellent selection of records. Then he arranged with the telephone company to place a special metal funnel over the ordinary transmitter. So when the family are enjoying a musical hour it is only necessary to place the mouth of the phonograph parallel to the telephone transmitter to let all the families on that particular line enjoy the music, provided the other subscribers take down their respective receivers and listen.

Commercial Aspect of the Automatic

F. DAGGER

I have read with considerable interest the article by F. J. Dommerque on the above subject in the March issue of TELEPHONY and were it not that statements have been made and figures quoted which are entirely inaccurate and misleading I should not have troubled you with any comment thereon, but in view of the statements made I feel that the importance of the subject is such that the article should not be allowed to go unchallenged. At the outset let me say that it is not to be expected that the manufacturers of manual switchboards will allow automatic exchanges to come into general use without straining every point to minimize and discredit the merits claimed for machine telephony. I would suggest, however, that the end in view will not be attained by the publication of statements and figures which every telephone manager knows to be inaccurate in general practice. I would also add that the article in question would have been more commendable had Mr. Dommerque confined himself to those systems which he has seen in operation, instead of entering upon sweeping condemnation of all systems, including those which he has never seen—a rather undignified position for an expert of his standing to place himself in.

I must confess that I do not follow Mr. Dommerque when he says that the Strowger switch corresponds in its make-up to a manual multiple switchboard. Perhaps he will explain in what respect the individual connectors of the Strowger correspond to the percentage of cords for the common use of all subscribers on each section of a manual switchboard. With regard to the filler system, he tells us nothing beyond what is already known.

Mr. Dommerque states of the Lorimer that "the apparatus appears to be rather complex." Will he be good enough to explain when and where he has seen this apparatus, and failing in that, what authority he has for making such a statement? The fact is that Mr. Dommerque knows nothing whatever about the Lorimer machine telephone beyond what has been published in the press, and therefore is not competent to pass any judgment on it. He does not even appear to know that it is a common battery system, or is not candid enough to give this information, although he goes to the trouble of stating in italics, that it includes a common return wire, and omits the important fact that the latter is used only for signaling and forms no part of the speaking circuit. Will he be surprised to know that a grounded line at each station would serve the same purpose and that every station has a complete metallic circuit?

With regard to the transmission of speech the Lorimer system in no way differs from the best common battery system; therefore his reasoning on this point falls to the ground. Moreover, the number of contacts in a completed connection between two subscribers is less than those on a manual switchboard and the circuit in the exchange being solid copper, instead of cords of more or less resistance in the standard of transmission, the Lorimer system has the advantage.

Dealing with Mr. Dommerque's reasons why, in small exchanges, automatic service is not commercial, he must surely have a very limited idea of human ingenuity if he imagines that the points he raises are insurmountable. It is most undesirable in small, and prohibitive in large, exchanges for a telephone operator to perform the duties of an information bureau, in addition to that of attending to calls. Such a practice leads to indiscriminate gossiping on the part of the operator to the detriment of the service and should be discouraged. If an information bureau is necessary it should be conducted as a separate service and can be arranged for at a cost proportionate to the size of the exchange in an automatic, as it should be in a manual exchange.

There are already in operation several automatic exchanges operating farmer or party lines, and there is nothing to prevent other systems from devising means to give a similar service.

The cost of small automatic exchanges, he states, is 100 per cent more than corresponding manual apparatus, which is not a fact. Taking the cost per line for, say, fifty subscribers at $10, instead of $5, we have a total additional cost of $250. Does Mr. Dommerque mean to assert that an amount equal to the interest and depreciation on $250 will pay for operating continuously day and night (as the automatic does) for 365 days an exchange of fifty subscribers? Such a service, at the lowest estimate, would cost $30 a month, or $360 per annum, which represents fifteen per cent, or $2,400—$45 per line.

The local and long distance toll business presents no difficulties such as Mr. Dommerque would have us believe. This service would be provided for in a manner best suited to the amount of traffic in the locality, just as is the telegraph service in county towns and villages to-day. Furthermore, between many points the service can be entirely automatic with tolls abolished, thereby giving the subscriber service over an extended area for the same rate that he now pays for a purely local service. In fact, the automatic system will give the rural districts facilities which they do not now enjoy, not the least of which is a continuous day and night service and communication over a larger area. Space prevents me from enlarging on these points, but I assure Mr. Dommerque that he has much to learn on this subject before he again sets out to prove that the automatic system is not commercial in small exchanges.

The testimony of unprejudiced users of automatic exchanges does not corroborate Mr. Dommerque's statement that in point of speed there is no advantage. Innumerable statements could be produced in proof of the fact that more rapid connections are obtained through automatic exchanges, that there are fewer delays and no inaccuracies, and what is of great importance to all subscribers, their conversations are free from interference on the part of the over zealous operator, who cuts in to hear if you are talking, or disconnects before you have finished.

The statement that "any automatic apparatus must necessarily be more complicated than a manual apparatus and the chances for trouble greater" would have come with greater force from an expert of Mr. Dommerque's standing if he had produced some evidence in support thereof. An assertion of this kind made in regard to systems which he has never seen is entirely valueless, and therefore may be passed over without further comment. An automatic exchange is not dependent upon the human frailties of operators. That it provides the same capacity for service at all times, day and night, is proof against labor and other disputes which in many manual exchanges has caused inefficient service; moreover, it is not necessary to provide for the frequent resignation of operators, many of whom are experts, and the subsequent disorganization of the service, due to the substitution of inexperienced operators.

I would point out that the continuous working of the central energy manual system depends entirely on the power plant, and in this respect the Lorimer machine telephone in

no way differs from the former, and is therefore no more liable to become "sick." Providing the power plant is in good order the service must be continuous; therefore, Mr. Dommerque's argument may be applied with equal force to the modern manual system, which is equally dependent on the efficiency of the power plant.

Is it not a fact that most modern systems use a "ground" at each subscriber's station for lightning arresters? This being so, there is no such increased cost as stated. Mr. Dommerque knows that the grounded wire in manual systems forms part of the speaking circuit, and is used to save the cost of a second wire from the exchange; whereas in the automatic system it is only used for signaling the speaking circuits, being absolutely metallic.

In dealing with figures Mr. Dommerque makes a serious error when he assumes that all automatic systems costs the same amount to manufacture and install as the Strowger. I will, however, accept his comparison for the moment and see how it works out in actual practice. In the first place, I challenge Mr. Dommerque to furnish reliable proof of a single exchange in which the total cost of a central office equipment, with a completed working capacity of 5,000 subscribers' stations, has cost only $16 per subscriber, including the manufacturers' price, freight, placing in position, cabinet work, wiring of multiples, operators' equipments, storage batteries and power plant, switchroom furniture and such accessories, which form a necessary part of a modern manual system. I venture to assert that $30 per subscriber would be nearer the mark; in fact, I know of at least one system costing that amount. As a case in point I may say that noticing some time ago a published statement that a company had contracted for a 6,000-line switchboard at a cost of $126,000, I wrote to the general manager of the purchasing company and received a reply to the effect that the contract price was very much more than the published figures, although he was not free to divulge the exact amounts. I could give other instances, but in view of the facts known to telephone managers of large systems, it is unnecessary to seek to further disprove Mr. Dommerque's figures. I am aware that the manual switchboard manufacturers take every possible precaution to prevent the actual cost of central equipments becoming public, and that it is therefore difficult to ascertain the truth in regard to this matter, but it is perfectly safe to assume that the combined cost of subscribers' telephones and central manual equipment for a 5,000 line will reach at least $38 per subscriber, viz., the same cost as the Strowger. Again as grounded lines are a desirable factor for safety, for lightning arresters at subscribers' stations, this item may also be omitted from our calculations. The estimate for local batteries is again absurdly high, as with the use of dry cells $3,000 would be a liberal allowance. So far then we have a difference of $3,000 per annum in favor of the manual exchange as against the Strowger.

We now come to the cost of manual operators. Does Mr. Dommerque wish your readers to believe that a 5,000-line exchange can be operated at a cost per subscriber of $2.74? If so let him name an exchange where this remarkable economy is effected. In the meantime the following figures will form a basis for our calculations:

The cost of operating in Cleveland, according to the latest report of the Cuyahoga Telephone Company, averages $4.70½ per subscriber per year. In Glasgow, Scotland, where wages are so much less, the estimated cost is $5.52. In Rochester, New York, some time ago, at an average of $5.44 per week, the operators' wages equaled $5.80 per subscriber per year. C. E. Curtis in TELEPHONY gives the operating cost in an exchange, apportioning 200 lines to an operator, as $1.72 per 1,000 calls. Thus, 60,000 calls per day, 300 days per year, with 5,000 subscribers, equals $6.19 per subscriber per year.

A description published in the *Electrical World and Engineer* of the central energy equipment of the Brooklyn Exchange gives the operating staff for 3,500 subscribers as 100, which at $20 per month gives an operating cost per subscriber per year of over $6.85. The average of these five instances is $5.80, which gives an operating cost for 5,000 subscribers of $29,000 per annum, to which we add the wages of two trouble men at $75 per month, bringing the total up to $30,800. Against this we have two items: $3,000 for batteries and $4,500 for trouble men, or a total of $7,500 to be deducted, leaving a balance in favor of the automatic of $23,300 per annum. Suppose, however, that we accept Mr. Dommerque's figures regarding the Strowger as correct, there is still a balance in favor of the automatic exchange of $3,988 per annum, which, capitalized at 5 per cent, equals $69,760.

With the Lorimer machine telephone the first cost of a 5,000-line exchange would be two-thirds less than that of the Strowger, while three attendants only are necessary for 6,000 subscribers; therefore, a comparison between that system and the manual would be much more favorable to the automatic, even if all Mr. Dommerque's figures were correct.

With regard to party line service in cities, those who have tried the system will admit that it is dear at any price. It may be a necessary evil with manual systems, but the day is coming when the automatic systems will give direct line service at lower rates than are at present charged for party line service. There is also no difficulty in the way of arranging automatic pay stations in connection with the automatic exchange. In fact, all the arguments of Mr. Dommerque are only the product of an imaginative brain, and have no foundation in fact. I may remind him that greater men than he have essayed to discredit the inventive genius of others and have lived to realize their mistake. No less a genius than Sir Walter Scott advised that the pioneer of the present system of gas lighting be put in confinement as a lunatic, who would cause the wholesale destruction of human life if his ideas were allowed to be carried out, yet history records the benefits conferred on the human race by this invention. I assure Mr. Dommerque that automatic telephony has come to stay, and all the manual experts in the world will be unable to retard the advance which it will make in the next decade.

DEAF TO ALL BUT THE TELEPHONE.

A walking telephone caused considerable amusement to pedestrians in the shopping district on Sixth avenue. J. Chester of Glendive, Mont., was the curiosity and the speaking tubes and 200 yards of wire that were carried upon his person caused no little excitement among the passing throng. A sign upon his chest which read, "Yell hello! and wait for the bell to ring," was an invitation of which many men and women availed themselves.

Chester wrote on a piece of paper that he is a deaf and dumb inventor on his way to Washington, where he is going to get a patent on his telephone contrivance, which assists "deaf persons to hear and dumb persons to talk." He asks questions by means of a little tin whistle, through which he lisps and breathes at the same time. The sound thus produced is very distinct, but resembles a Punch and Judy dialect. He receives the reply through a miniature telephone transmitter. The telephone is connected with the ear by four feet of insulated wire, and receives its current from a dry battery carried in his overcoat side pocket.

Chester says he is a graduate of the Columbus (Ohio) Deaf and Mute asylum. His journey from Montana has occupied several weeks, as he stopped off at many towns and cities on the way here to exhibit his invention.—*New York Press.*

DIGEST OF TELEPHONE PATENTS

Conducted by Edward E. Clement

754,968—Telephone. M. C. Burt.

This is a magneto transmitter, having a diaphragm *K* carrying the concentric ring armatures *k*, etc., and concentric ring magnets *F* etc., having their poles opposite the armatures and provided with separate windings. The poles are perforated for ventilation, and an external switch serves to cut in one or more of the windings *f*, etc., as required.

755,054—Service meter for telephone lines. Scribner & McBerty.

This is an important case. Nominally a service meter or call register at the subscriber's station is presented, but the claims appear to cover broadly a polarized electromagnet at the sub-station controlling the talking apparatus, together with means at the central office for sending current in one or the other direction over the line.

The circuit as shown works in connection with a standard relay circuit of the Bell company at the central office, the only change being the crossing of the battery connections at *g-g*, so that while the tip and sleeve of the answering plug *f* are respectively positive and negative, the tip and sleeve of the calling plug *f* are, respectively, negative and positive. Current opposite in direction is thus caused to circulate in a calling and a called line, respectively, without any special act on the part of the operator.

At the sub-station a polarized magnet *k* is connected around a non-inductive resistance, and controls an armature *k'* and contact lever *k3*, which normally closes a shunt around the transmitter *a3* through the contact *k4* and wire *10*. The subscriber calls by taking down his receiver *a2* as usual, but cannot talk to central until the shunt *10* is broken, although he can hear. In order to break the shunt he presses in button *1*, which pushes the prop *m* under the end of lever *k3*, lifting it off the contact *k4* and latching at *k2*. In doing this, the lever 1^1 scores *1* on the register 1^2. In order to prevent the button *1* from being fastened in by an ingenious beat, so as to keep the shunt permanently open, the button itself closes a second shunt *11* on spring 1^3, around the whole set. The prop *m* must be in, therefore, and the button *1* must be out, in order to converse.

On a called line, the current works the magnet *k* at the outset to turn the armature *k'* and open the shunt *10*. Hence, it is not necessary to register.

755,091—Telephone transmitter. J. A. Williams.

This is a granular transmitter, having the diaphragm *d*, a felt ring *j*, and a rear electrode formed as a concaved projection *i* in a plate *i'*, whose periphery rests on the felt ring and is held against the same by the spring *k* whose end is perforated and rests against a coned head *13* to permit alignment of the plate without binding. A felt damper *1'* under a limiting screw *1* checks excessive vibration, and it will be observed that the entire carbon chamber and both electrodes vibrate with diaphragm.

755,127—Electric selective system. J. A. Gehrung.

This is an improvement on system patented to Mr. Gehrung August 6, 1901, No. 680,036. The general idea is to have magnets at each station wound and adjusted to currents of particular strengths only. Each station has a pair of magnets *6-6* controlling the armatures *7* and *11*. The first magnet is sensitive, and the second non-sensitive to the same strength of current. The second magnet at each station preferably takes the same current as the first magnet at the next succeeding station. The armature *7* must be up and the point *11* must be back in order to close the local circuit *9* and ring the bell *12* at any station. To ring *No. 1*, the last key *1* at central is depressed, sending a very weak current to line, which may be alternating or intermittent produced by an interrupter *5*. This energizes the first magnet *6*, but not the second, at the first station, hence *10* closes on *11* and the bell *12* rings. I may remark here that for convenience the bells are in secondary circuits, having windings directly on the magnets. If the second station is wanted stronger current is sent, which works both magnets *6* to pull up both armatures *7-11* at station *1*, but only the first armature *7* at station *2*. Hence the bell at the latter station will ring, but not at the first or any succeeding station.

755,229—Coil for electromagnet or other purposes. F. Klingelfuss.

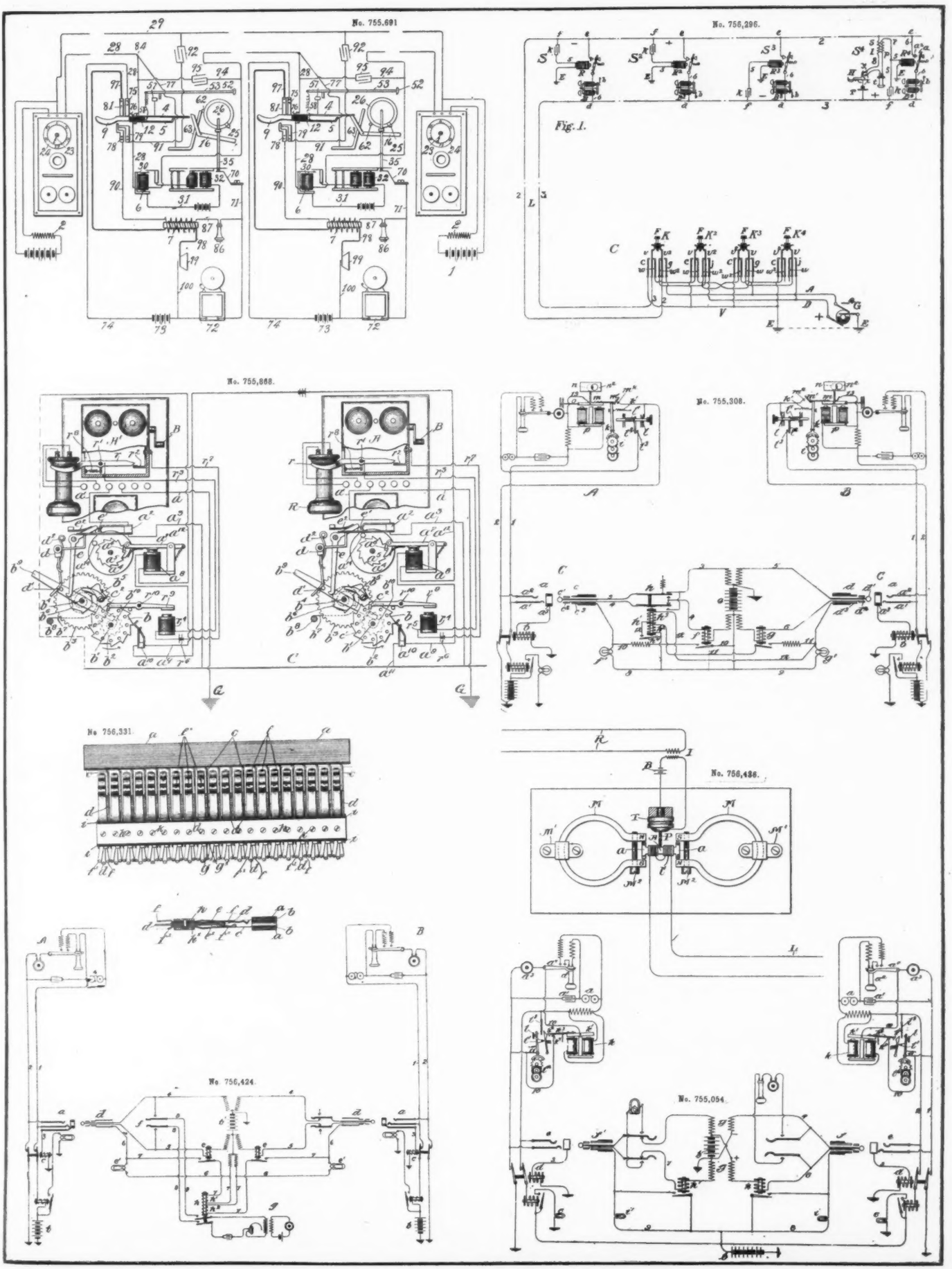
This is a means for laying up the windings for electromagnets in layers, somewhat similarly to the Varley method recently patented. Pressed discs of paper or similar material are employed, and the wire laid on them in spirals, the paper discs being assembled on a spindle or on the core as the winding progresses.

755,308—Service meter for telephone lines. F. R. McBerty.

This is a modification of the Scribner & McBerty Meter System, described above. It virtually makes the called subscriber his brother's keeper, for when he answers the call he puts the calling subscriber out of business unless the latter punches his register button. The central office circuits are the same as usual, standard relay type common battery, with the addition of a pole-changing switch *h* controlled by the magnet *h'*, having two windings *h2* and *h3*, the first controlled by the supervisory relay of the calling plug, and the second in a shunt of the first normally open at its own armature.

At the sub-station a polarized magnet *p* is connected to work on the drop around a non-inductive resistance, and controls a target *n*, this indicating to the calling subscriber when his correspondent has answered and it is time to punch the button. The talking circuit goes through the frame of the push button *1*, which works the lever *k* of the register, normally latched under the end of the spring *m'* and holding it off the contact *m2*, thus breaking the shunt *13* around the transmitter.

The subscriber *A* calls as usual, and the operator goes through the usual procedure. When the subscriber *B* answers, his supervisory relay *g* pulls up, shunts out the lamp *g'* and in the shunt *11* includes the winding *h2* to energize the magnet *h*. This pulls down switch *h* and reverses current on the line to station *A*, whereupon magnet *p* turns up the armature *m*, unlatches the lever *k* (thereby initiating the registration of the call) and closes shunt *13* at contacts *m'*-


No. 755,691
No. 756,296.
Fig. 1.
No. 755,868.
No. 755,308.
No. 756,331.
No. 756,436.
No. 756,424.
No. 755,054.

m2. At the same time the target *n* tells subscriber *A* that to talk he must push the button.

755,515—Counting system for telephones. J. H. Meyer.

Mr. Meyer of Magdeburg, Germany, presents herein a call register system similar in its functions to those of Scribner & McBerty just described. The subscriber calls and after the operator has the desired connection she sends current to line to break his talking circuit. He must then press the button of his register to restore his circuits.

The normal line circuit is complete from the subscriber's instrument at *y* to the central office annunciator at *B*. When the operator plugs in at *A* she throws the listening key *h* to the right and afterward to the left, thereby putting the battery *Z* on the calling line *a-b* and energizing magnet *E*, which unlatches the target *s* and closes a shunt around the telephone at 5. This current also energizes relay *R* to light a supervisory lamp, and to maintain battery on the lines. When the connection is complete the calling subscriber is told to press his button, which he does, thereby working the register and momentarily breaking the line-circuit at *i*, whereupon relay *R* lets go its armature, puts out the lamp, cuts out the operator, and completes the talking circuit.

755,691—Telephone selective system. N. S. McKinsey and A. R. Nelson.

The inventors in this case announce their object to be the provision of a system applicable wherever telephones are used. It is to be feared that in its present form its use will go no further than the announcement. The scheme is for a step-by-step party-line selective system, depending upon clockwork mechanisms, relays, and a considerable aggregation of push buttons, levers and springs. Each clockwork has a hair spring balance wheel with extremely delicate mechanism—a "thread" for a detent, not to mention tilting contact levers acting differentially, and the like. Two line-wires are employed, one, *29*, being merely the return and remaining unbroken from station to station. The other passes through normally closed contacts on the hook and through a relay at each station. The main arbor of the selector wheel comes through the front of the box and carries an indicating hand. In making a call, the receiver is taken off the hook and the latter rises, breaking the main circuit. This de-energizes all the controlling relays *6*, which energize the local relays and release the clockworks. The latter then progress in perfect synchronism (or so it is hoped), and one telephone after another is cut in by contact pins set at different distances around their respective wheels, the main circuit being held closed in the meantine by a push-button at the calling station. When the desired station is cut-in the caller's indicator shows the proper number and he lets go the push-button. The bell at the called station is in a local circuit, and rings until the receiver is taken down.

It is stated that listening in is impossible during conversation because of the initial movement when the receiver is first taken down, and because of the inability to rest the contact wheels as long as the line is in use. There are some good points in the system, this being one of them, but no telephone instruments will ever get into commercial use as long as they are loaded with so much intricate and delicate mechanism.

755,868—Telephone system. Robert Hamilton.

The last inventors hailed from Susanville, California, and Mr. Hamilton comes from Milton, Mass. This is a striking exemplification of the widespread character of the step-by-step epidemic. The present invention is an improvement on those patented to Jackson in December, 1900, No. 664,757, and May, 1901, No. 673,796. Therein calls are made by either depressing a button or setting a pin in the path of an arm. The primary object in the present case is to prevent a line from being hung up by the user neglecting to step the mechanisms back to zero, or to pull out the pin. All switches go back to zero when the receivers are hung up.

Assuming the switch mechanism to be the usual form of a step-by-step wheel, the invention may be stated in a few words. It comprises a stop movable into and out of the path of some part of the wheel to hold it, a magnet controlling the stop and means for closing the magnet circuit when the receiver is hung up, this being shown as a switch momentarily closed by the hook.

756,091—Telephone cabinet. W. B. Altick.

This is a booth or cabinet having a curved collapsible front, adopted to be pulled out and around the user to close the booth, and to be folded back, like one side of an accordion, when not in use.

756,183—Telephone call attachment. J. J. Nye.

This is a speaking tube fitted on to a telephone so that people in different rooms can hear the bell ring and can use the instrument from a distance. The inventor, Jason J. Nye, lives in Brookfield, Vermont, the land of true economy, and it is dollars to doughnuts that he keeps a hotel. If there is not an Independent company in his town to reduce rates so that telephones will be cheaper than speaking tubes, there ought to be. If there is, then they need missionaries.

756,296—Selective signaling for polystation telephone circuits. B. Stryker.

This is a very carefully prepared case, bearing the name of Thomas D. Lockwood, which always inspires interest, not to say curiosity. The invention relates to four-party lines with selective signaling, and makes use of the old arrangement of a bridge of a metallic circuit and a ground tap on one side or the other at each station. According to the old scheme a sluggish relay was in the bridge and served to close the normally incomplete ground tap through the biassed bell. According to the present scheme the relay is placed in the ground tap, together with a condenser, and when energized it closes the normally open bridge through the biassed bell. This is the system freed from disturbance by trespassing currents from trolley or other lines.

756,331—Spring-jack for telephone switchboards. M. S. Conner.

This is a good thing. It looks in the direction of economy and should prove efficient for its purpose. The idea is to dispense with the plate uniting the front and rear portions of a strip of jacks and support the rear part directly by the tongues or rearward extensions of the test thimbles, which are held in holes in the front strip. The front strip *a* is of hard rubber drilled as usual for the test thimbles, whose stems or tongues *c* are set vertically out of line with the springs, but have each a stiffening flange *d* extending out laterally between the springs of the corresponding jack. A strip of insulation *e-e'* on each side of the flange enables it to serve as an abutment or stop for the springs. All the springs and tongues are clamped together as usual at their rear ends between metal plates *h-h'*, with proper interposed insulation.

Mr. Conner is the engineer of the Stromberg-Carlson Company, Rochester, N. Y., and has contributed substantially to the development of this art. The present design shows the hand of experience.

756,424—Secrecy system for telephone switchboards. E. H. Smythe.

Mr. Smythe is a Western Electric man and his invention is assigned to that company. It is shown in connection with standard relay circuits, and comprises means for positively cutting off the operator while both supervisory relays are energized. The conception is very pretty and its embodiment is simplicity itself. The listening key *f* connects the operator's circuit *8-8* as usual to the cord, but in this circuit

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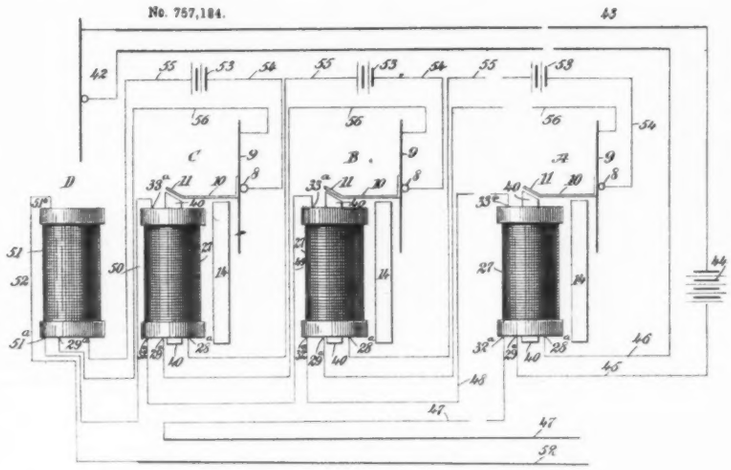

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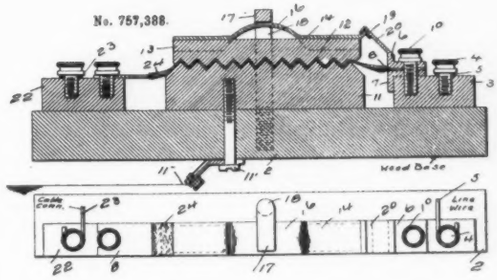
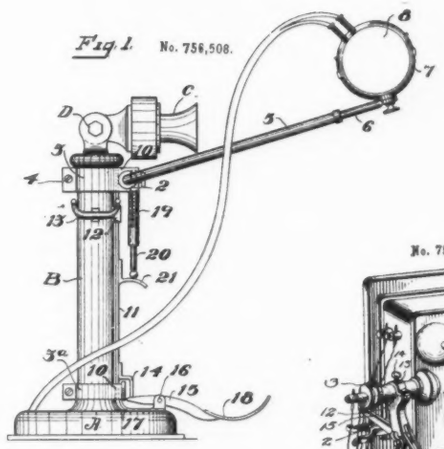


Fig. 1. No. 756,508.



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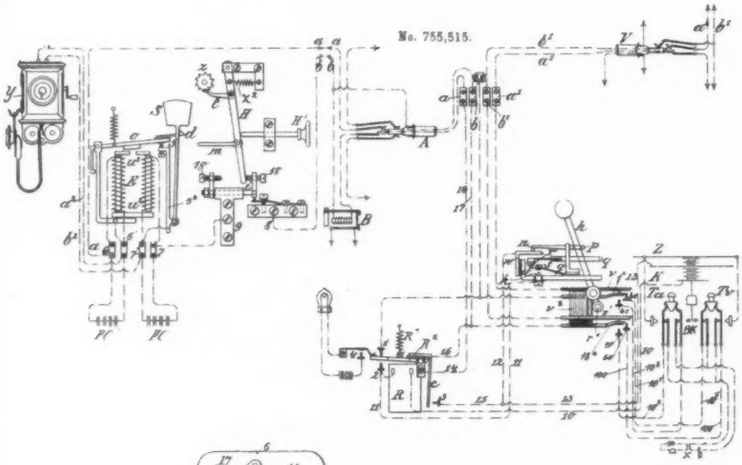

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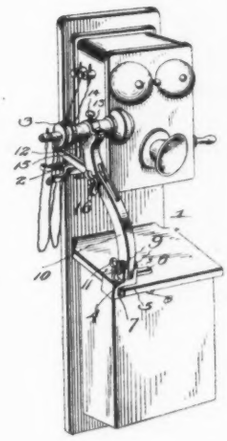

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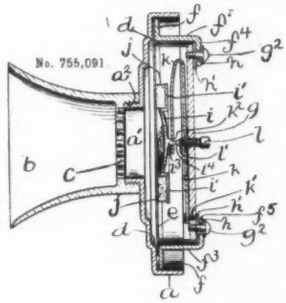

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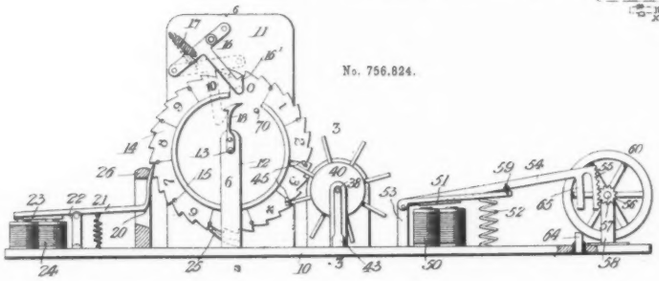

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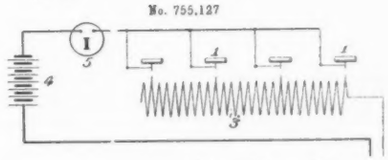

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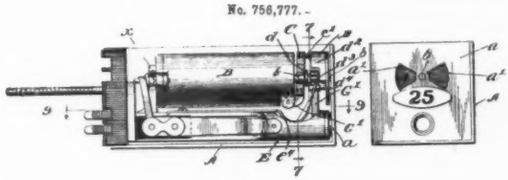

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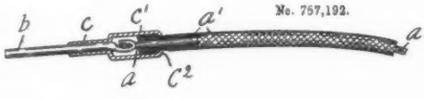

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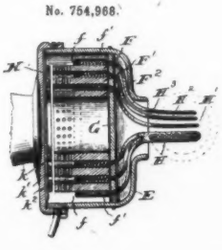

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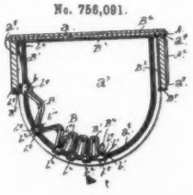

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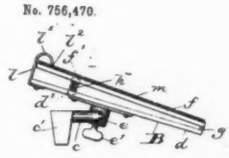
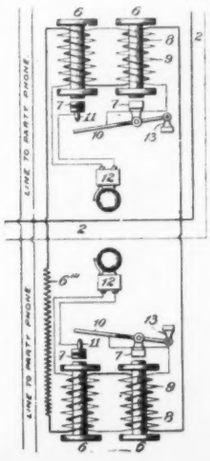




are extra contacts controlled by a cut-off relay *h*, which is differentially wound, and has one winding in each supervisory lamp shunt, controlled by the supervisory relays. When a call is answered the first supervisory relay takes current and its shunt is closed, so the relay *h* also takes current effectively and closes the break in the operator's circuit; but when the called subscriber answers, the second supervisory also gets current and closes its shunt, so both windings *h'* and *h2* on relay *h* take current and the relay remains neutral, letting go its armature and cutting off the operator regardless of the position of the listening key. If either subscriber hangs up the operator can listen in, as she should, because then the relay *h* gets current in one winding only. During idleness of the cord neither winding is active, and the operator is therefore normally disconnected.

756,436—Telephony. John Trowbridge.

756,437—Telephone. John Trowbridge.

Professor John Trowbridge is an authority in certain lines, and has been working with telephonic relays for a long time. The invention discribed in these two cases is the same, one covering the apparatus and the other the method, in accordance with the absurd practice of the Patent Office at the present time, which holds practically that if method and apparatus are so intimately related that they can be presented in the same case then the method is merely the function of the apparatus and so is unpatentable as a true method. The invention is simple. It comprises a balanced armature in a magnetic field with circuit connections to its coils, the whole so arranged that movements due to changes in the current are at right angles to the "receiving member," or front electrode of the transmitter. In other words, referring to the drawing, an armature *A* carrying coils *1'*, is balanced between the poles of magnets *M-M*, and is connected by right line rod *P* to the front electrode of a solid back transmitter button *T* rigidly supported. The coils are in one circuit, the transmitter in the other. The method claims are interesting. Here is one of them:

> The method of transmitting messages, which consists in transforming electrical undulations into qualitatively corresponding magnetic undulations within a supplemental magnetic field, producing thereby qualitatively corresponding resultant magnetic product undulations, and causing qualitatively corresponding mechanical vibrations quantitatively proportionate to the resultant magnetic product undulations, thereby quantitatively enhancing the mechanical result while preserving therein the characteristic quality of the original electrical undulations.

After studying this claim, perhaps due reverence will permit the reader to qualitatively assimilate the resultant product of corresponding co-ordination, but I think he will need to refresh his cerebral discharge centers before he will be able to quantitatively appreciate the correlated positions of his own corpus and the rest of the universe.

756,508—Telephone attachment. C. Konigstein.

This is an attachment for a desk telephone comprising a receiver support and a connection for operating the switch-hook. The receiver support consists of a telescoping tube and rod *5-6*, the former being supported by having its bent over, or return portion, locked in a socket *2* on one side of a sleeve *3*, by means of a set-screw *9*. The sleeve *3* at the top and a similar sleeve *a* at the bottom of the desk standard support a sliding bar *11* normally pressed down by spring plunger *20* working in a tube *19*. The user works the switch either by grasping the standard and lifting against the hook *21*, or by resting his arm on the lever *18* pivoted at *16* and having its inner end engaging the slide at *14*.

756,543—Sanitary attachment for telephones. H. L. Thompson.

This is a book whose paper leaves are perforated so that they can be torn off readily and folded around the mouthpiece of a transmitter. The Patent Office sometimes issues curious things. It is very doubtful if the claims of this patent can be sustained, there appearing to be no patentable invention involved.

756,555—Cabinet. W. B. Altick.

This is another telephone cabinet having a fixed top, bottom and back, the front and sides being formed of sliding jointed wooden screens, which are normally pushed back on their casters to lie inside the back, one behind the other.

756,470—Memorandum holder for telephones. O. G. Byers

It is said that no two snowflakes were ever exactly alike. I presume it is the same with these patented telephone attachments, but there is an evident dearth of language to split hairs already split, for claims are becoming more and more limited, or, as it might be said, long and narrow. In the present case the pad plate *f* is pressed up against the paper cutter (1^2) by the spring *h*, and the bed-plate *B* is carried on an arm whose terminal tapered plate *c'* fits into a taper socket, or slide, on the side of the telephone desk.

756,777—Electrical annunciator. A. Carliss.

This is a new form of the "express" type of combined drop and jack long manufactured by the American Electric Telephone Company to whom the patent is assigned. It comprises a tubular magnet *B*, having a pivoted armature *C*, through which a pin *b* extends out from the end of the core, a rotary target *D* being mounted on this pin. The target is circular and weighted on one side, being normally kept turned with the weight up by a detent *c'* on the pivoted armature *C*. When the armature is attracted the target turns and shows a different color through the windows *a'* in the front of the casing. A long spring *e4* overlies the jack *E* and is pushed up by the plug when inserted to rotate the target back to normal. Night alarm terminals are closed by a pin on the target.

756,813—Long distance telephone system. M. Beck.

"There are more things in heaven and earth than are dreamed of in thy philosophy, Horatio." And this is one of them. It is a private line arrangement with two terminal magneto instruments, each containing a rheostat, a telescoping tube for the switch-hook, a magneto transmitter of the type that Graham Bell designed twenty-five years ago, with a hollow core to talk through; two terminal batteries, one for each instrument and shown as each containing nine cells; a "powerful" central battery shown as having thirty cells (giving presumably about sixty volts) and a relay to cut in and out this main battery. The relay contacts break under oil, which, I should say, was highly necessary. Likewise the rheostats at the terminal stations.

The most curious idea of the whole thing is the telescoping tube, having one end fixed to the switch-hook and the other to the box. After you have rung your man awhile a coil of wire in this tube of his gets heated up, and expands the air, so the tube lengthens out like an automatic slide trombone, to open the ringer circuit. If he doesn't answer pretty soon, the air cools and the trombone shuts up again so the bell can make a little more noise.

756,824—Telephone selecting device. L. E. Brock.

Another step-by-step selector with the usual functions of showing when the line is busy and locking out those that are not elected for the time being. A magnet *24* in the line steps around a toothed disk *14* as many teeth as a calling subscriber sends impulses. Pins *45* on this disk co-operate with fingers *3* to turn a disk *40*, which carries a contact that turns around over a series of contact points. The traveling point and one of the others are connected in the local bell

circuit, so that by stepping around to the right number the local circuit can be closed at one station, but will remain open at the other. The talking circuits are connected in through the lever *16* pivoted at its left-hand end and adapted to be thrown down from its full line to its dotted line position to latch at *18*. A pin on the latch end of the lever then passes through the notch *o*, which is normally up, and is trapped inside a raised flange *15* on the disk *14*, the pins of all the other instruments being similarly trapped outside of their flanges.

757,184—Megaplex relay. R. A. Engler.

The word "megaplex" is intended to convey the idea "of an amplifying device used for strengthening electric pulsations and undulations." The construction of the relay is simple, comprising a vertically set electro-magnet *27*, with a polarized tongue armature *10* connected to the diaphragm *9* of a microphone *5*. The instrument could not possibly be very efficient for telephonic frequencies, on account of the masses of metal shown in the magnetic circuit, as well as the opportunities for loss in the long mechanical connection between the armature and the diaphragm of the repeater. The circuit arrangement is very curious. The initial transmitter works the primary of the first relay (the relays being also induction coils). The transmitter worked by the first relay in turn working the primary of the second relay, and so on, the secondary windings of all the relays being connected in series and into the main circuit for transmission. It is quite probable a largely increased noise results from this arrangement, but as each successive circuit would have its current waves lagging somewhat behind the one before it, it is a question just what sort of a hybrid or composite noise would result.

757,192—Tip or terminal for electric wires. S. C. Houghton.

This is a tip for cords, having split sleeve *c'* pinched together on the insulation *a'* of the cord, and enclosing the connection of the cord conductor to the pin *b*.

757,257—Telephone receiver support. J. A. Brown.

Here is a support that can be clamped on any telephone desk and adjusted to fit any receiver hook. I might add that it would take no great amount of scheming to conceal the wires. This is one of the best devices of this character that has come up yet, because it is practical. The arm *10* holds the receiver at its upper end, is pivoted with a locking thumb nut on the clamping base *6*, and carries an adjustable arm *15* to extend over the hook. When not in use the whole thing is pushed back and the hook is held down.

757,340—Telephone support. H. H. Oothoudt and W. F. Stahl.

This is a desk stand bracket made of bent and twisted wire pivoted to a base and carrying clamps.

757,388—Lightning arrester. G. Babcock.

This is a high potential arrester consisting of ground and line plates, having their abutting surfaces separated by a strip of insulating material such as silk, the faces being corrugated and the silk pressed into the corrugations. Covered by the silk may be a feed wire, also pressed into the corrugations and provided with terminals *8*, being connected in series with the instrument or circuit. When a high potential discharge occurs the silk is supposed to be carbonized.

Of the 105 counties in Kansas probably not more than a dozen are without rural telephone service, while some of them have as many miles of rural telephone lines as they have of railway tracks.

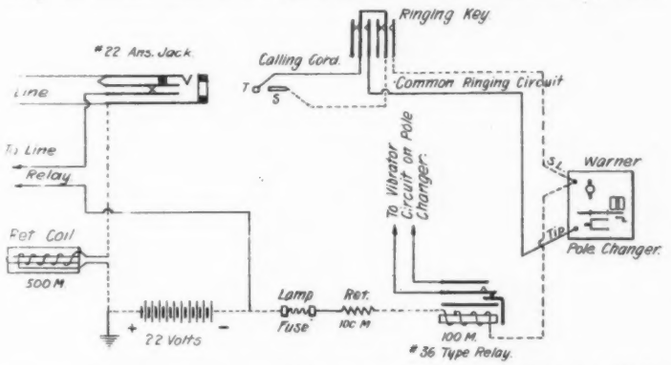
METHOD OF OPERATING A WARNER POLE CHANGER.

BY F. H. WRIGHT.

Assuming that several readers of TELEPHONY have the same common battery equipment as shown in the figure, I submit for the benefit of those who have failed to discover the appliance of the referred to system, in connection with the operation of the Warner pole changer, the following circuit arrangement that is possible, simple in operation and easy to install.

By referring to the figure, you will observe that the operation of the vibrator on the Warner Pole Changer is controlled by the action of relay No. 36, and that the action of relay No. 36 is controlled by the ringing key; consequently, the vibrator will not operate only during the act of ringing, thereby prolonging the life of the Edison battery (or any other that may be used) and the contact springs on and in connection with the operation of the vibrator.

The permanent connection to jack of a 500 ohm. retardation coil to positive battery makes this arrangement more easy to install and more positive in action than in any other



system that has been brought to my notice. All that will be required to accomplish the installation of this circuit arrangement is as follows:

One 100 ohm. relay with single make contact; a 100 ohm. retardation coil and a small fuse block, which is to be connected in the following prescribed manner:

Take one terminal from relay winding to sleeve side common ringing circuit on pole changer, as per cut. The other terminal from relay winding passes through 100-ohm. retardation coil and a one-ampere fuse to negative battery. Then proceed to run terminals from contacts springs on relay, cutting them in series with the local vibrator circuit on pole changer.

By again referring to the figure and tracing the dotted lines you can readily see the cause of the operation of the No. 36 relay, which to make as plain as possible is as follows:

Positive battery flows out through 500 ohm. retardation coil to jack, when the calling plug is inserted in jack, then on through sleeve of cord to key, and during act of ringing onto sleeve side of common ringing circuit to pole changer; thence to No. 36 relay (the operation of which closes vibrating circuit on pole changer), then on through 100 ohm. retardation coil and a one-ampere fuse to negative battery.

I have been operating the pole changer, as above described, for some time, and so far have failed to discover any objection whatever in the operation of same.

Since the telephone has become the vogue in the rural districts, it is difficult to see where the city dweller any longer has the advantage over his rustic brother. The heart beats of the whole world now throb in the ears of each simultaneously, which brings them into closer touch, each with the other, into friendlier and more profitable relations man to man, giving each an opportunity to better understand and appreciate the other.

Municipal Telephony in England

HERBERT LAWS WEBB

The province of a critic is never a wholly grateful one. That of a critic of affairs telephonic is peculiarly ungrateful, by reason of the great technicality of the subject. During the past year I have acted once or twice as a professional critic of municipal telephone schemes, and have realized that it is almost hopeless to expect to convey to a non-technical arbitrator and to non-technical advocates a clear idea of the technicalities of a modern city telephone service. It would be somewhat remarkable if it were otherwise, as could one make a telephone man of a local government board inspector, or of a town clerk, in a day, it would be hardly worth while to spend fifteen years of one's life in getting on familiar terms with the telephone business.

It is chiefly, no doubt, owing to the extreme technicality of the telephone service, both on its engineering and on its business side, that the telephone business is so much misunderstood. Very few men, even among electrical engineers, outside those directly engaged in telephony, have any conception of the innumerable details and difficulties that beset those in charge of the telephone service of a large city. The whole business, like the telephone plant itself, is made up of a multitude of details, and none but the wearers of the telephonic shoe can appreciate in how many different places that shoe may pinch at once. The very methods of operating the service and the machinery by which it is operated are almost unknown to the majority even of electrical men, and I doubt if at any ordinary meeting of the Institution you could find one man in ten who properly understands the principle of the multiple switchboard, or could correctly describe the method of passing calls from one exchange to another.

In the face of this general unfamiliarity with telephony it is not surprising that a few town councils have run away with the idea that telephony is a cheap and easy business. The great mistake they have made has been to make it too cheap. In most businesses a reduction of 20 to 25 per cent would be considered a big cut in prices, and would be sufficient to attract custom. But the municipal telephonists started out to cut the price in two, and made there a fundamental error. Having adopted an impossible price, they have had to try to cut their telephonic coats to fit the price—a process in which the coat suffers, both as to quality and serviceability.

During a period of nearly fifteen months I have watched closely the progress made in municipal telephony, and from my notes I summarize the chief points in which, according to my observations, municipal telephony is unsound. These are:

1. The rates have been fixed too low.
2. The capital cost has been underestimated.
3. The technical policy is antiquated.
4. The business policy is erratic.

Municipal telephony was originally founded—cart-before-the-horse style—on a £5 flat rate. The rate was fixed in advance, and then the councils started in to try to live up to it. One municipal system now working actually has in force a rate of £5 for unlimited service, but the other few have gone above £5. Now, a flat rate of £5 for unlimited service in a large city is selling the service below cost price. If a first-class plant is built, and a first-class service supplied, the fixed charges for interest, sinking fund and depreciation, if depreciation is properly recognized, will amount to about £4 a subscriber, and the actual operating expenses cannot safely be put at such a low figure as £1 or even £2. If message rates, on the plan of a fixed charge for maintenance and a small charge for each message, are to be offered (as they now must be according to the P. O. license) the flat rate should be considerably higher than £5, as the message-rate subscribers always give a very small revenue and pull down the average.

The £5 rate has been arrived at by underestimating the capital cost—which necessarily leads to undervaluing the fixed charges—by neglecting depreciation and by underestimating the operating expenses. The early estimates of capital cost for municipal telephone systems promised an average cost per line of about £15. At Glasgow in 1897 it came up to £18 16s, and at Glasgow in 1900 to £19 1s. It has since ranged between £18 10s and £20. The actual average capital cost per working subscriber's line of the Glasgow system, according to the 1903 accounts, works out at nearly £35. The actual average cost of the other systems cannot be told at present, as they have not been sufficiently long at work to present accurate data.

The principal reason for real cost being so much greater than estimated cost is that municipal telephone schemes have apparently counted with always having a paying subscriber on every line provided. It is one of the hard facts of the telephone business that this happy state of affairs does not occur in practice. There are many reasons why it cannot occur, but, as I am not writing a report, I shall not give them all here; suffice it to say that the experienced telephone man knows that in a city system not more than 60 to 65 per cent of his plant will be actively employed at any one time. Therefore, to be on the safe side, the telephone manager should reckon his average capital cost accordingly. Of course, it may occur that from lack of foresight or lack of money—or through physical difficulties—a telephone system gets filled up and has to refuse orders. But to refuse orders is not the proper way of conducting the telephone business; what should be aimed at, and provided for, is free and unrestricted development.

The underestimating of capital cost has naturally not been dissociated from an unprogressive technical policy. If the work had to be done cheaply, cheap work was naturally bound to result. In 1901, when the first large municipal telephone system, that of Glasgow, was started, the relay or common battery system had become standard practice. This method of operating the telephone service offers so many advantages that it has become almost the only method of working in the United States, for small as well as for large exchanges, and is rapidly spreading over Europe. In 1901, when the Glasgow municipal exchange was building, the New York Telephone Company, then serving some 60,000 stations, completed the conversion of its entire city system—comprising a dozen large exchanges—to relay working. At the same time Glasgow adopted the old Law system, or call-wire, a method of working which has so many disadvantages that it finally disappeared from the United States, though originally produced there, well back in the last century. In Portsmouth and Swansea the method of working the municipal exchanges is according to another cumbersome system; the subscriber has to keep a button pressed down until the

operator answers, and then to ring his correspondent himself when connected.

At Brighton municipal telephony has at last discovered automatic signaling, but the talking is by local battery, and the instruments are provided with generators to facilitate "ring-through" maneuvers. So that the technical policy of municipal telephony is still, after three years' practical work, well behind the known and established state of the art at the time when municipal telephony began. Consequently neither are municipal telephone subscribers getting the grade of telephone service they ought to get, nor are the corporations which have engaged in the telephone businsss in possession of the kind of telephonic material that ought to be theirs—considering that they all engaged in the business during the present century.

Of the business policy of municipal telephony the reader may discover the consistency from the following table, showing the population and municipal telephone rates of the five cities which have adopted municipal telephone schemes:

City.	Population.	Municipal Telephone Rate for Unlimited Service.
Glasgow	760,000	£5 5 0
Hull	240,000	6 6 0
Portsmouth	190,000	5 17 6
Brighton (and Hove)	160,000	5 10 0
Swansea	95,000	5 0 0

Hull, with a third of Glasgow's population, is to charge 20 per cent more than Glasgow. Portsmouth, with a quarter of Glasgow's population, charges 12½ per cent more than Glasgow. In the large city, with its large area and multiplicity of exchanges, telephone service costs appreciably more to furnish than in the small place; yet in municipal telephony the largest city has the cheapest rate. This is excepting Swansea, which, for some reason I have not come across, adopted the even £5 of the early days of the municipal telephone crusade.

Similar variations will be found between the message rates and party line rates announced by the municipal telephone departments, with a similar absence of reason and logic. In making dispassionate note of the foregoing points I trust I have set down an unbiased record, for technical and unbiased readers, of a subject which unfortunately usually arouses an alarming amount of heat.—*London Electrical Times.*

THE TELEPHONE GIRL AND CUPID.

In the realm belonging to the modern "office woman" the day of the telephone girl has arrived. From a matrimonial standpoint she reigns supreme. The throne first filled by the "show girl" cashier and then by the dashing stenographer is now occupied by the pretty and attractive young person who sits at the switchboard. This is the verdict of observant employers who have all three classes of working women in their offices.

"It's the little hello girl that takes the cake nowadays," said one business man. "She marries and quits her job with a rapidity that's astonishing. The young men don't seem able to resist her, and I don't blame them. You see, a girl that comes into an office to answer calls at the switchboard often does so directly from her own home. So she's fresh and pretty and absolutely unspoiled by business life. And she apparently sweeps all competitors clean off the field. I'll bet that every daily marriage license list in cities contains the names of one or two girls who used to do telephone work in some big office. They don't put down their ages at 40 years, either, the way some business women have to do. I guess 19 is about the true figure."

The enthusiastic employer, who is the father of a large family and takes an almost paternal interest in the young men and women in his store, got down a card index and proceeded to verify his assertions with a few statistics.

"We keep a card record," said he, "of the career of every one of our employes, and I think I can use it to prove what I'm saying. In the last two years we've had twelve switchboard girls and four of them have left to get married. Since 1895 we've employed eighteen women stenographers, and only one of them has notified us of her wedding. The three women bookkeepers and cashiers that we have had ever since the house was founded twenty years ago are all unmarried. A fourth member of this department left us two years ago to get married and committed suicide soon afterward. This last instance is probably too extreme to be of any statistical value, but it actually happened.

"Look at that little girl over there," pointing at a cheerful, healthy little woman who was busy pulling telephone plugs in and out and making soft answers in an automatic manner; "she's been here about three weeks, and all of the young clerks are 'crazy about her,' as my daughters say. I'm not running a matrimonial agency, but I don't see any harm in it as long as all concerned attend to their business and don't try to flirt or fool.

"That young woman has a running start on the stenographer or cashier as far as getting a husband is concerned. She didn't have to go through a long course of preliminary instruction to get her present job and she can quit it for the altar and a three-room flat without feeling that she is 'abandoning a career.' Furthermore, her position at the

telephone board gives her opportunity to make a much wider acquaintance than the cashier in her wire cage or the stenographer in a private office.

"It's funny," he continued, reminiscently, "to see the changes that have come about in this matter. Business men don't like to talk about it much because of that dislike to the matrimonial agency idea which I just hinted at. But the comic papers furnish the best indication of the shifting of the sovereignty. Twenty years ago the beautiful woman cashier was the butt for all the jokes about jealous wives and impressionable husbands. Then the stenographer had her turn, and it's about time for the humorists to wake up to the fact that it's the girl at the switchboard that's now queen of the office workers.

"I never heard of one marrying her employer, the way typewriters sometimes do, but they certainly do get married. There's no doubt about that. And when they do get married they stay at home and keep house. They don't drift back into the business world again, as stenographers often do.

Telephony.

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A DIGEST OF TELEPHONE LITERATURE.

In another part of this issue we announce the entrance of Samuel G. McMeen into the field of general engineering practice. As is well known, Mr. McMeen for many years has been connected with the various activities of the Bell telephone companies.

We take much pleasure in announcing the conclusion of arrangements by which TELEPHONY will present, from month to month, as a permanent feature, a Digest of Telephone Literature, that department being conducted by Mr. McMeen. We believe there will be no doubt in the minds of any that his long experience, wide reading and deep study fit him to conduct such a work in a most able manner.

The value of a thoroughly good digest of this sort is widely recognized. The busy man who wishes to keep in touch with the times, but is unable to read all the periodicals, even if he has access to them; the earnest student, who is willing to absorb columns in print if only he can be told where to find what he is in need of; the English-reading telephonist to whom the foreign periodicals are sealed—these will appreciate the digest and find it of great value. None the less will it appeal to those who need a permanent index for future reference, that they may turn readily to an article whose contents are recalled but whose source is forgotten.

Should any element of the digest interest the reader to the degree of making him wish more detailed information, the Digest Department will be glad to do either of three things—answer willingly and without charge any definite question, accompanied by a stamp, about an article; furnish a copy of the periodical containing the article, if its price and postage are sent, or furnish an English or other translation in full of the article digested from a periodical in a foreign language. We make no charge for our services in this connection.

It is our expectation also to secure from Mr. McMeen and to present, from month to month, telephone articles of immediate and timely importance. The series already planned and under way covers in the most practical, direct and lucid style, the actual best practice of to-day, and in such a manner as to possess two great values: First, it is clear, exact and entertaining, so that it is useful to the beginner, as it tells him, at all stages, the *reasons* for things; second, it is authoritative, and serves as reliable guidance to those actually engaged in the practice of the business.

We congratulate our readers and ourselves upon the opportunity presented as a result of these arrangements. We mean to present, as occasion shall permit, other and special articles from Mr. McMeen's pen, bearing on such phases of the science and the art as shall make such contribution seem particularly valuable and fitting.

The telephone is the pulse of the commercial world.

THE BELL KELLOGG COMPANY.

The music of a Chinese fiddle has never attained popularity, even though the age of the instrument runs back into the early centuries. It represents the heathen's conception of the beautiful. The heathen were satisfied with the music that was produced on an instrument with a single string. It is gratifying that civilization has rendered it difficult for us to live in accord with the heathen's ideal. We dislike the constant strumming of the single string. It does not satisfy what we are pleased to call our finer sensibilities. Nevertheless, we are required at times to do considerable fiddling on a single string, or harp continually on a fixed subject, which is much the same thing. We are referring again to the Kellogg company.

For the past several months we have devoted consider-

able space in advising Independent telephone companies that the Kellogg Switchboard & Supply Company was a Bell concern. To the vast majority of these operating companies, the first announcement was all that appeared to be necessary. Patronage was withdrawn and orders were placed with those manufacturing concerns that were loyal to Independent progress.

Since the decision was handed down last March. sustaining the Bell demurrer to the suit brought by the minority stockholders of the Kellogg company, the matter has rested. And well it might, for this suit was instituted to set aside the sale of the controlling stock in the Kellogg company to Bell interests. The decision that was expected by Independents and the decision that resulted, left the Kellogg company in the possession of the Bell.

Mr. Kempster B. Miller, who was most prominent as an aggressive element among the minority stockholders, has now left the company to resume business on his own account. This action is pointed out as being significant, for Mr. Miller was the conservative believer that the Bell sale would be set aside. It is quite probable that Mr. Miller now believes with the rest that the legal ownership of the controlling stock by Bell interests is complete.

It is quite another matter to conjecture what the Bell proposes to do with apparatus bearing the Kellogg nameplate. The factory is in operation and telephones and switchboards are being regularly finished and carted to a warehouse where they are systematically stored. There appears to be no sale for this product in the Independent field and Independents have no means of knowing what final disposition will be made of this accumulation. The company having failed to dupe Independent operators by any previous trick, may have concluded to give away its apparatus as souvenirs at the St. Louis exposition!

The telephone is the most useful gift of science to mankind.

SELF-RESTORING DROP PATENT SUIT DECIDED.

A decision was handed down in the United States Circuit Court of Appeals at Chicago on April 11, 1904, in the case of the Western Telephone Manufacturing Company vs. the American Electric Telephone Company, et al., in favor of the former company. The decision is on the self-restoring telephone switchboard drop and is as follows:

The main divide in this case, as presented in argument, lies along the line whether, as appellees insist, Fisk intended the operator to use the plug as a tool with which to restore the drop while the operator was moving the plug to the mouth of the jack, or, as appellant contends, he conceived the idea of having the plug automatically and inevitably restore the drop by the plug's insertion into the jack. The expressions in the patent, "the drop . . . is lifted by the plug as it is inserted in the jack," "the drop . . . is raised by the entrance of the connecting plug (into the jack)," "the drop . . . to hand in front of the jack and be lifted by the plug as it is thrust into the jack (and be held by) a trigger or arm . . . when so raised," leave no doubt in our minds that Fisk contemplated automatic restoration of the drop by the action of the plug during its insertion into the jack.

Did he disclose a practicable means for carrying this idea into effect? "Plug K" of the patent is nowhere specifically described or pictured. This omission and a comparison of the size of the jack-opening with the distance through which the drop must be raised to reach the catch as exhibited in Figure 1, have led appellees to assert that the patent shows no way of restoring the drop through the action of the plug except by using the end of the plug to poke (as one might with his finger) the drop into its latched position before inserting the plug into the mouth of the jack. But the drawings are not required to be working plans; they must be read in connection with the description and claims; and any inferences arising from omissions or inconsistencies in the drawings must yield to a legally sufficient specification. "Many material objects and operations," says Robinson (Vol. 2, Sec. 491), "are so familiar to the inventor and his readers that their specific description, or even an allusion to them, would be superfluous. The law recognizes these difficulties in the way of an absolutely complete description and overlooks the defects which they occasion . . . though it omits appliances, modifications, or processes which persons skilled in the art would know were necessary and would themselves supply. Though it fails to describe implements and materials that are common in use or methods of construction generally practiced in the arts, it may be complete enough to put before the already trained and informed intelligence of the reader an accurate and entire picture of the invention, from which he can understand it, construct it, and use it as easily as if all these familiar acts and objects were particularly described." The specification calls for a plug of such a form in relation to the form and location of the drop and jack that the mere act of inserting the plug into the jack will restore the drop to its latched position. Plugs with hafts to limit the thrust were common. It seems clear to us that any one who was familiar with existing switchboards and plugs and who on reading Fisk's patent desired to embody the invention in the specific form of Figure 1, would see that the blade of the plug as it was thrust into the jack would not lift the drop into its latched position unless the bent portion of the drop were extended to equal the distance between the latch and the mouth of the jack, and that if the drop were not so extended the haft of the plug should be of a form and size to lift the drop to its latched position. That is, it would be purely a matter of the particular builder's choice whether he used the extension on the drop or on the plug or both.

It is not denied that Fisk's device is useful and novel and that the exercise of the inventive faculty was required in its production. The reference patents are claimed by the appellees to limit the scope of the invention so as to save their device from infringing. Inasmuch as Fisk was the originator of the principle of *restoring the drop by the contact therewith of the plug as it enters the associated jack,* and the deviser of a practical embodiment of that principle, we deem the prior exhibitions of automatic restorations of the drop when disassociated from the jack and accomplished by means *dissimilar to the contact of the plug with the drop as the plug enters the jack,* to be utterly irrelevant to the question of infringement, as they are confessedly insufficient as anticipations. If appellees are using Fisk's invention as it is defined in the patent, it is immaterial how much of the prior art they also employ. Appellees' drop is restored from a horizontal to a vertical position; Fisk's from a vertical to a horizontal, according to Figure 1 of the drawings. But in the description and claims there is no limitation upon the position of the drop, except that it must be in front of the jack to the extent that the plug will lift it to its latched position as the plug enters the jack. Appellees' drop contacts with the plug through the cam projection on the drop. We have already stated that we regard it as immaterial whether the contact is effected through having the plug reach up or the drop reach down or both. We, therefore find that appellees' device responds to the claims of the Fisk patent as we read it.

That Overshiner improved upon Fisk, and, indeed, developed an idea that never occurred to Fisk, is no warrant for using appellant's property without leave.

The decree is reversed, with the direction to enter a decree in appellant's favor for an injunction and an accounting.

There is no premium on ignorance in the use of the telephone either by subscriber or operator.

THINKING.

Since time began, the effort of the individual has been to find the surest and easiest way to supply his needs and to gratify his ambitions and desires. This is still so; witness for example, the multitude of writings and public speakings concerning How to Get On; Success in Business; How to Become Rich Though Poor, and so on to the end of the list.

The wide interest aroused by Mr. Damon's paper concerning "Opportunities in the Electrical Business," and the discussion provoked by its presentation, both of which were treated in our last issue, brings one's attention again to the importance of the fundamental question. In the paper, in the contribution by the selected one hundred Chicago engineers and in the discussion at the meeting, much attention was given to the feature of the engineer's preparation, the advocates of one or another method of preliminary training, each presenting the features favorable to his method. As is usual in matters of such breadth, a definite conclusion was not reached.

So far as a generalization may be made at all in a matter so entirely of human interest, it would seem that the keynote in the matter of preparation and preparedness was struck by Dr. Perrine, whose contribution to the discussion

bore upon the value of thoughtfulness. Whatever amount of whatever character of classified or unclassified facts the student may collect in the course of his study, these alone will prove of no real final value unless they are assimilated and digested to become a part of his intellectual being, and this digestion and assimilation can only be accomplished by thinking, *thinking,* THINKING.

The application of the telephone in the operation of both steam and electric railway lines has developed into what is almost a new system of order and report.

SHALL IT BE TELEPHOGRAM?

In the April TELEPHONY reference was made to the difficulty being experienced by telephone users in settling upon a perfectly derived word that would adequately and intelligently describe a conversation held over a telephone—a word as euphonious and as applicable for the purpose as is the word "telegram" in describing the sending of a message by telegraphy, and which would eventually be as generally accepted and used.

The word "telelogue" was given as having been suggested to TELEPHONY, and the request was made for others to evolve, if possible, a still more appropriate word for the purpose desired. As a result of this request TELEPHONY has already received scores of replies bearing upon the question, the large majority of which are either not practical, or are imperfectly derived words. The one word that, thus far, more nearly seems to fit the requirements of the case, in the estimation of TELEPHONY, has been suggested by Mrs. Dell Shoots of Rushsylvania, Ohio, who offers "telephogram" (te-lef-o-gram) as a solution of the vexatious problem. This is a more euphonious word than "telelogue" and has much to recommend it, but the principal objection to it is its marked similarity to "telegram," which is the more evident when one repeats the word "telephogram" rapidly.

Essential as the telephone is now to the conduct of affairs, no one can state, except as a general principle, why a person subscribes for a telephone.

WILL FURNISH MUSIC BY TELEPHONE.

The Scriptural truism, "Of the making of books there is no end," seems to apply with equal force, in a general sense, to the telephone and the multudinous uses to which it may be put. Scarcely a day passes that some individual or corporation does not come forward with a new invention or scheme for making the telephone of still greater importance in the field of commerce. Granting that many of these enterprises are in a large measure visionary, and fail of realization for various reasons, there are still not a few that possess real merit; that embody enough of practicability and good points to interest men of brains and capital, who are not slow to invest their dollars where a show of possible adequate financial returns is satisfactorily demonstrated to them by the promotors for any investment they may make.

By way of illustration a case may be cited—one of more than ordinary interest and importance on its face, as the men behind the proposition are said to be worth millions, and are ready to invest an immense sum to further the plans of their novel scheme to the point of a dividend paying proposition. The plan is to furnish music over the telephone to subscribers in all parts of the country—not simply popular airs and ragtime ditties, but grand opera melodies and halleleujah choruses, if desired. There is nothing new in the idea of transmitting or listening to music over the telephone, but the novelty of the proposed undertaking lies in the fact that men of reputed prominence and wealth have reduced the operation to a business basis, and propose to put the plan into practical every-day use.

The Cahill Teleharmonic Company is the name of the corporation which is back of this new telephonic enterprise. Its incorporators are leading Baltimore capitalists. The mission of the company is to put music on tap in every subscriber's household by telephonic arrangement. By pressing a button, a home can be filled with stirring music in the morning to arouse the occupants to begin their day's work, or at night to lull them into peaceful slumbers. It is only a question of time, it is declared, when this service will be furnished commercially, just as gas, electric light, water and telephone service is now supplied.

The invention is a machine for producing every primary vibration known to the human ear. These range from minimum vibrations that can be heard sixteen a second to a maximum of 8,000 vibrations a second. Also for public playgrounds, hospitals, factories, hotels, restaurants and homes the world's best music will be supplied. Music can be transmitted long distance—across the continent if desired. It may be sent to subscribers over telephone or incandescent circuits. One may unscrew an incandescent lamp, connect the translator and have the service without interfering with the lights on the same bracket. Telephones may be used to ring up the exchange of subscribers, but not to talk over when used for this service.

How long will it be before every establishment has at least one telephone?

VALUE AND EFFICIENCY OF THE TELEPHONE

Dr. Louis Bell, formerly editor-in-chief of the *Electrical World,* contributes a highly interesting article to the "Labor Saving Number" of the *Engineering Magazine* on "The Relation of Electrical Inventions to Human Activity," wherein he pays tribute to the value of the telephone, as follows:

As an energy-saving device the telephone far outranks most inventions classified as great. Within its own particular sphere of usefulness—the saving of time in necessary communications—it is incomparably more efficient than the telegraph, since it can accomplish in a three-minute conversation more than could be done by the interchange of half a dozen telegrams extending over a couple of days. More than this, it has an immense value in local communications which are without the field of telegraphy. Aside from its importance in saving the time of business and professional men to an extent which can hardly be calculated, it also takes a very high rank as an invention of convenience, in facilitating general communications of purely personal interest. It bears a relation to that part of industry which does not directly depend upon manual effort comparable only to the substitution of automatic machinery for hand work, and in its relation to the industries and methods of a complex civilization it should perhaps take place as the greatest single invention, aside from printing and the railroad.

In the case of the telephone it is possible to get an approximate idea of the extent to which it is used in everyday affairs. In the United States alone there are in regular use close on to two million telephones, so that it would probably be well within bounds to say that ten million people come within their sphere of influence. As many more may probably be reckoned as occasional users of telephones, so that the sum total rises to twenty or twenty-five per cent of the whole population. This is the more remarkable as the telephone is unrelated to the ordinary labor-saving devices which one naturally expects to find in very extensive use. It does not, of course, reach to the very roots of industry, as do inventions which increase the efficiency of manual labor, or bring to hand the forces of nature; but outside these basic considerations its position is unique.

Vessels are equipped with telephones whose lines are connected as soon as the crafts are moved to their piers, and as the boat is secured to the land, so the interests which it bears are attached in like manner to the greater world through the instrumentality of the telephone.

THE SELF-RESTORING DROP CASE DECISION.

The decision by the United States Circuit Court of Appeals, Chicago, in the self-restoring drop case, printed on page 367 of this issue, is of interest to all manufacturers and users of magneto switchboards.

The case was brought about eight years ago by the Western Telephone Construction Company against the American Electric Telephone Company, P. C. Burns and others, and was for the purpose of sustaining the validity of the Fisk patent on self-restoring drops. The defendants, who manufactured under what is known as the Overshiner patents are found by the court to be infringers, and are ordered to account for all infringing drops made. They also are enjoined from further manufacture of such drops.

The decision establishes the claims of the Fisk patent in a much broader sense than has hitherto been the common opinion. The court finds that "Fisk was the originator of the principle of restoring the drop by the contact therewith of the plug as it enters the associated jack."

The full force of this language is more apparent when it is recalled that the defendants' device in the case just decided was furnished with an intermediary cam or attachment to the drop shutter, without which the plug used would not have restored the drop. The defendants urged in their briefs that this was indirect restoration, or restoration through an intermediate and separate device.

The court in finding against the defendants confines the field to the claims of the Fisk patent upon all drops which are similar to those made by the defendants. Other manufacturers contend that their switchboard drops are dissimilar from those made by the American Electric Telephone Company, upon various grounds, the principal of which are the "indirect methods of contact."

It is a well-known fact that a court decision is often as hard to construe as are the respective rights of the parties before the suit is decided; but in this decision the language of the court is clear.

As an agent of civilization, as an educator in the broadest sense of the word, the telephone has accomplished more in a brief score of years than have all the wars in the history of the world.

A RURAL PRODUCE EXCHANGE.

A rural produce exchange, established by the Penn Yan (N. Y.) Telephone Company for the use of its rural patrons, is one of the latest innovations in the field of telephony. The Penn Yan Company already has 200 rural subscribers, and A. M. Taylor, manager of the company, says there are in excess of 200 more telephones contracted for, which will place the number of rural telephones that are switched at the central station at Penn Yan at over 400.

Manager Taylor conceived the idea that a general information central would be appreciated by his rural patrons, so, in accordance with this idea, he placed a large blackboard in a cigar store. As an illustration of how it works, let us suppose that a rural subscriber living on one line, has a horse, cow, grain, or any other marketable article for sale. He calls up the produce exchange, giving the number of his telephone, and states what he has to sell. This information is placed upon the blackboard.

Now let us suppose that another subscriber, residing on a different line, wishes to purchase something of the sort that has been listed, and asks the produce exchange who has horses, cows, etc., to sell. He is given the number of the telephone of the party who has for sale such articles as he has inquired for, and then he calls by telephone and finds what he wants without running all over the adjacent country.

There is no doubt, Manager Taylor states, that Penn Yan will have, before the end of the year, 1,000 telephones, all connected directly with the central exchange, a phenomenal thing for a town of 5,000 inhabitants.

The Penn Yan Telephone Company has been in operation a little over a year, and is one of the best equipped and most modern small exchanges in the country. The central station equipment consists of one common battery switchboard with lamp line signals and double lamp supervisory signals. It has two positions of 160 each for local calls and one position equipped for toll and rural lines.

The switchboard cabinet is of handsomely finished quarter-sawed oak, and with the arrangement of the lamp line signals, lamp supervisory signals, and other equipment, it shows that no expense was spared in making the plant thoroughly modern. The woodwork of the relay rack and of the main and distributing cross connecting racks is of the same finish and design as the switchboard. They are fitted with sliding glass doors and are placed immediately back of the switchboard.

The power plant consists of two sets of twelve cells each of 80-ampere hour storage cells, which are charged by a motor dynamo of 500 watts capacity. The power board regulating the charging and discharging of the batteries is of marble, on which is mounted the voltmeters, ammeters, switches, circuit breakers, etc. The fuse panels are of marble, on which is mounted the regular fuse protection.

The auxiliary equipment, such as ringing machines, pole changers and wire chief's testing desk, is complete in every respect, and ample facilities have been provided for the handling of the large volume of long distance calls which come in over the lines of the Inter Ocean Telephone and Telegraph Company.

The outside plant is built in a most substantial manner. The poles are large and stocky, and nothing but the full size standard cross arm is used. About 30,000 feet of aerial cable has been strung. The larger part of the open wire is copper, and, all in all, the plant is considered to be one of the best smaller plants in the United States.

The company has about 500 well satisfied and contented subscribers on the local board and about 250 subscribers on the rural lines ending in the switchboard. The people of Penn Yann declare that the service is entirely satisfactory.

This plant was built by the Century Telephone Construction Company of Buffalo, N. Y., and the central station equipment and sub-station instruments were manufactured by the same company in their Buffalo factory.

TELEPHONE BELL SAVED FUNDS.

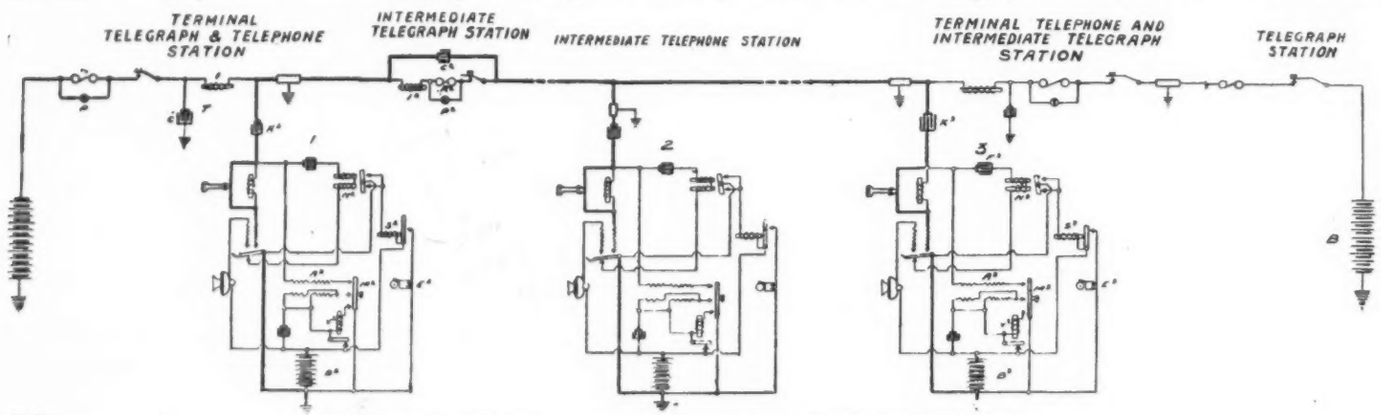
Usually a "cross" on a telephone line proves something of an annoyance, owing to the frequent ringing of the bells. But for once a "cross" has proved a blessing, according to this press dispatch from Elnora, Ind.: "Recently while burglars were at work in the National bank at Elnora, Ind., a crossed telephone wire caused a bell in the institution to ring. Evidently thinking it a burglar alarm, the robbers hastily departed. The safe had been drilled and nitroglycerine and a fuse had been inserted."

A press item from Somerset, Pa., states that the Maryland, Pennsylvania and West Virginia Telephone and Telegraph Company has about concluded terms for the stringing of a through trunk line from Connellsville on the system direct to Rockwood on the Somerset county system, which will establish service and connection, not only with the Somerset County Telephone Company, but through it with the Independent companies operating at Johnstown, Cumberland and their connecting companies, all of which combined have from 8,000 to 10,000 telephones.

Composite Telephony and Telegraphy

A. J. FERGUSON

THE Canadian Pacific Railway has equipped its telegraph lines between Montreal and Ottawa with composite telephone and telegraph apparatus, which allows telephone service to be added to grounded telegraph lines without interfering in any way with the telegraph service already carried on over such line. As the name implies, the system has been designed especially to meet the demands of railway companies for a service of this character applicable to terminal or way stations of lines of the above character. The length of the telegraph line and the number of way stations with which this system can be successfully employed depend largely on the character of the telegraph lines. The size and the material of the line wire and the amount of wire in cable are the most important factors limiting the range of the system. In general, it may be stated that it is usually possible to operate successfully over an ordinary telegraph line one hundred miles in length having five intermediate stations.



RAILWAY COMPOSITE TELEPHONE AND TELEGRAPH CIRCUIT.

The general arrangement of the system is shown in the accompanying diagram. At each terminal of that portion of the line over which telephone messages are to be transmitted is placed a terminal differentiator, consisting of an impedence coil in series with the line wire and a condenser from the line wire to earth.

As the telegraph battery is placed outside this piece of apparatus the latter serves to graduate the rise and fall of the telegraph currents so that Morse signals will not interfere with the telephone service and so that inductive or other disturbances will not be transmitted to the telephones from portions of the line beyond the coils.

Each telegraph way-station is provided with an intermediate differentiator, consisting of a condenser and impedance coil. The impedance coil is placed in series with the telegraph relay, and relay coil and key are shunted by the condenser.

This apparatus affords a by-pass through the condenser for the telephone talking and signalling currents. Were it not for this apparatus the talking currents would be seriously reduced by the impedance of the relays and the telephone signaling currents would cause the relays to "chatter" or give false signals.

In addition to the above precautions the relays are directly bridged by polarization cells. The latter offer such opposition to the passage of the direct telegraph currents that their presence does not in the least interfere with telegraphic signaling. At the same time, they serve as a shunt for any telephone signaling current that, passing through the impedence coil of the intermediate differentiator, would otherwise affect the relay.

Each telephone set is connected to the line through a condenser, thus avoiding interference with the telegraphic service.

The set, in addition to the transmitter, receiver and induction coil, contains, for calling, a special vibrator operated by a push-button; and for receiving calls, a direct current bell controlled by a slow-acting relay, which, in turn, is controlled by a biased, polarized relay. For signaling and talking, a battery of five or seven Edison-Lalonde cells as found necessary is provided at each station.

The station set is arranged to be mounted on the wall. A special transmitter is employed with these sets. The receiver is of the standard type but is permanently shunted by a special impedance coil which is designed to divert from the receiver the traces of the telegraphic or other currents which otherwise would cause disturbing noises to be heard.

This impedance coil has a movable iron core which can be inserted into the coil, or removed from it, to a greater or less degree, thus widely varying the impedance and regulating the proportion of the current that is shunted around the receiver. The value of this impedance should be as high as is consistent with the necessary freedom from disturbing noise.

The circuits used in the railway composite system are shown in the accompanying diagram. This diagram shows at the left a terminal telephone and telegraph station, next toward the right an intermediate telegraph station, next a telephone station which may or may not be associated with the preceding telegraph station, next a terminal and telegraph station, and beyond an isolated telegraph station. All telephone stations are connected between the line and earth.

At the extreme left hand terminal of the line is shown one of the telegraph batteries B, the telegraph relay R of the combined telegraph and telephone terminal station, the polarization cell P shunting and relay R, and the terminal differentiator T, consisting of impedance coil I and condenser $C\,I$. The telephone set at this combined station is connected to the line through condenser K^2.

At this station B^2 represents the local battery of five or seven Edison-Lalonde cells. The transmitter, hook-switch,

induction coil, receiver, and its shunting impedance are represented conventionally.

At V^2 is a vibrator, operating through a coil, with a condenser placed around the vibrator contact, and the operation of the vibrator controlled by a key M^2. This portion of the equipment provides the high frequency signaling current.

At N^2 is a biased polarized relay, and at S^2 a slow-acting relay, controlled by the former, and having connected to its own back-contact the direct current bell E^2. This portion of the apparatus is for receiving incoming signals.

At the next station (an intermediate telegraph station) is shown an intermediate differentiator consisting of impedance coil I^2 and condenser C^2. The relay R^2 is also shunted by the polarization cell P^2.

The remaining stations so closely resemble those referred to above as to require no further description.

To call a distant station, as for example, station 3 from station 1, the operator at station 1 depresses key M^2, which causes the circuit of battery B^2 to be closed through the vibrator V^2, the operation of which produces an interrupted current in the split primary winding of coil A^2 and consequently a similar induced current being transmitted through the condenser K^2, along the line, through the condenser C^2, of the intermediate differentiator to station 3, and beyond.

At station 3 this signaling current flows through condenser K^3 and F^3, and the polarized relay N^3 to earth. This current causes the armature of relay N^3 to vibrate, thus opening the circuit which previously existed from the battery B^3 through the slow-acting S^3 to earth. The armature of relay S^3 falling back, closes the circuit of the direct current bell E^3 which gives the signal.

The talking circuit is of the simplest character and requires no explanation.—*Canadian Electrical News.*

TO EXTEND INDEPENDENT TOLL LINES.

As the result of a conference of managers of Independent telephone associations, held recently at Indianapolis, there will be considerable interchange of long-distance messages. This will be undertaken by the United States Telephone Company of Cleveland and various other Independent companies of Buffalo, Pittsburg, Philadelphia, Wheeling, Chicago and St. Louis. These connections will make it possible to have service over Independent wires from Cleveland to Buffalo and Albany, Philadelphia and other cities named, also giving service to Kansas City and through Colorado and Texas. A forty-mile extension will be constructed from Dayton, Ohio, to Richmond, Ind., which will give the United States company connection through to St. Louis. This connection, it is expected, will be built and in working order before the exposition opens. Another extension, of about the same length, will be built from Dennison to Cadiz, and to the Ohio river. A small gap between Erie and Buffalo will be connected up, and this will give a circuit to Albany and Philadelphia; while another gap from the state line west of Toledo to South Bend, Ind., will be connected up, giving a through wire to Chicago.

IN A PLACE TOO HOT FOR TELEPHONES.

Telephone mistakes may have their serious sides. A man who wanted to communicate with another named Jones looked in the directory and then called up a number. Presently came through the receiver a soft feminine "Hello!" and he asked, "Who is that?"

"This is Mrs. Jones."

"Have you any idea where your husband is?"

He couldn't understand why she "rang off" so sharply until he looked again and discovered that he had called up the residence of a widow.—*The New Yorker.*

PERSONAL

A. Monson of Motley, Minnesota, has devised a new automatic telephone system.

Glen Tilton has been appointed manager of the telephone system at Collins, Iowa.

Howard Jones is now manager of the Home Telephone Company at Piqua, Ohio.

E. C. Aspey has purchased of A. Hensel the telephone system at Cheney, Kansas.

Golden Berry is interested in the promotion of a telephone system at Lincoln, Missouri.

John H. Grapotte has purchased the Independent system at Cape Vincent, New York.

J. A. Anderson is seeking a franchise for a telephone exchange at Dallas, Wisconsin.

D. M. Neill and others will establish a local telephone exchange at Red Wing, Minnesota.

G. L. Bickford and others have been granted a telephone franchise at Bowbells, North Dakota.

J. Nelson has been appointed manager of the Independent Telephone Company at Belton, Texas.

G. R. Waggoner has been elected president of the Mutual Telephone Company of Piasa, Illinois.

Elisha Rotrammel will install and operate an Independent telephone exchange at Keensburg, Illinois.

Bills Brothers will build a long distance telephone line from Sioux City, Iowa, to Lincoln, Nebraska.

Stephen Vankirk is at the head of the Independent company recently organized at Napoleon, Indiana.

J. R. Adamson has been granted a franchise at Ravenna, Nebraska, for an Independent telephone system.

R. Whistler and sons of Farragut, Iowa, have purchased the local exchange of the City Telephone Company.

R. L. Hopkins has sold the City Telephone system at Redfield, South Dakota, to a stock company for $50,000.

J. R. Sellers of Sellers, Missouri, has purchased the telephone line extending from that place to Gilead, Missouri.

Guy Merrill has been granted a franchise to establish an Independent telephone exchange at Albion, New York.

Clyde A. Mann of Sioux City, Iowa, has purchased the plant of the Independent Telephone Company at Eldon, Iowa.

H. H. Smith of Memphis, Tennessee, has been appointed manager of the Independent telephone system at Temple, Texas.

Captain J. W. Fortune and James Taylor are seeking a franchise for an Independent exchange at Jeffersonville, Indiana.

E. V. Combe is building a telephone line from Sierra de Almoya, Mexico, to Vaca Station, situated on the Mexican Central Railroad.

C. H. Randall is president of the new Independent telephone company which has just been organized at Wilkesbarre, Pennsylvania.

Mr. and Mrs. G. A. McKinlock of Chicago have sailed for a trip abroad. They will devote most of their time to

visiting points of interest in Italy, particularly Rome. Mr. McKinlock is president of the Central Electric Company, Chicago.

William Harper of New Haven, Connecticut, has been appointed manager of the Independent telephone exchange at Ansonia, Connecticut.

Charles H. Liken of Sebewaign, Michigan, has been added to the directorate of the Valley Telephone Company at Bay City, Michigan.

C. E. Pfeiffer, for the Home Telephone Company of South Bend, Indiana, sold $6,000 of its six per cent bonds to a western capitalist.

Rev. J. N. Pardea is chairman of a committee, which is investigating the cost of installing an Independent system at Bolton, Massachusetts.

C. L. Lawrence of Batavia, Illinois, has been appointed local manager of the Interstate Telephone Company's system at Prophetstown, Illinois.

Frank C. Smith of San Antonio, Texas, has purchased a controlling interest in the Independent exchanges at Austin, Taylor, Temple and Belton.

V. S. Smith will be retained as manager of the Bowling Green (Mo.) Telephone Exchange, recently purchased by the Buffum Telephone Company.

Manager N. L. Jones of the Sunset Telephone Company, Santa Rosa, California, is planning to establish a rural telephone service at Geyserville, California.

R. B. Abbott, well known in the electrical and telephone field, will be associated with the Chicago office of John A. Roebeling Sons' Company after May 1.

W. D. DeVarney, representing an Eastern electrical supply and telephone company, is seeking a franchise to establish an Independent system at Eugene, Oregon.

T. A. Hilton, president of the Wolverine Telephone Company, recently organized at Coldwater, Michigan, has asked for a franchise for a local system in Coldwater.

W. H. Johnson and Mrs. J. M. Ellis contemplate establishing a local telephone exchange at Brownsville, Texas. They will also build long-distance telephone lines.

Lee Kincaid and W. C. Scott are the chief promoters of a company of capitalists, which will construct an Independent telephone system in Menard county, Illinois.

H. B. Walter secured the contract for the construction of the new system of the Vermillion County (Ill.) Telephone Company, his bid of $16,000 being the lowest.

Congressman James A. Tawney has been elected president of the Winona (Minn.) Telephone Company, which will soon begin the construction of several rural lines.

J. C. Hume, secretary of the Mutual Telephone Company, Des Moines, Iowa, has purchased a new multiple switchboard and has closed a deal for financing the company.

A. G. Trimble has resigned as local manager of the Tri-State Telephone Company, Scottdale, Pa. Mr. Trimble made a good record in increasing the company's business there.

S. Tada, of the Japanese navy, and Messrs. Timita and Nishikawa, electrical engineers, of Tokio, are in this country to purchase electrical apparatus for the Japanese government.

Judge William N. Plymat of the Mankato (Minn.) Municipal court is seeking a twenty-year franchise at New Ulm, Minnesota, on behalf of the Mankato Citizens' Telephone Company, which is planning to enter New Ulm in competition with the Minnesota company, with headquarters at Willmar.

Garrison Babcock, formerly with the Stromberg-Carlson Co., is now in the Independent telephone construction business, and is located at 38 Rowley street, Rochester, New York.

W. C. Dillon, formerly superintendent of the People's Telephone Company of Birmingham, Alabama, has been appointed superintendent of the Memphis Telephone Company.

Charles Monk, formerly manager of the Pontiac, Illinois, exchange of the Central Union Telephone Company, has taken charge of the Independent telephone exchange at the same place.

A. Waller of Henderson, Kentucky, is the new president of the Ohio Valley Telephone League, representing thirty-three companies in the states of Ohio, Indiana, Kentucky and Tennessee.

Herbert Laws Webb, the well-known telephone engineer, has returned to England, where he has established a consulting engineering office at 35 Old Queen street, Westminster, S. W., London, England.

W. T. Brocksmit, formerly with the Independent Mutual Telephone Company at Shenandoah, Iowa, has been made manager, secretary and treasurer of the Central Iowa Telephone Company, at Iowa Falls.

W. E. Woolsey of Santa Rosa, California, is at the head of a new company that has just been organized in that city for the purpose of establishing a rural telephone system with headquarters at Santa Rosa.

A. J. Carter, formerly of the Seymour Telephone Company, Seymour, Iowa, has accepted a position with the Monarch Telephone Manufacturing Company, Chicago, as their Iowa and Missouri representative.

E. L. Miller, manager of the Wolverine Telephone Company at Coldwater, Michigan, recently made a tour of the Independent exchanges of Indiana. He has also purchased a new switchboard for the company.

William Moellering, manager of the Home Telephone Company at Ft. Wayne, Indiana, states that the company is installing new telephones at the rate of 100 a month, and that there are now 300 applications.

C. C. Vandeventer of Kingman, Kansas, was elected president of the Southwest Kansas Telephone Association, recently organized at Wichita, and representing 8,000 telephones and 20,000 miles of toll line.

Senator O. F. Berry, J. I. Hendricks and W. E. Simmons have purchased the Dr. Young line and Farmers' Exchange at Carthage, Ill., and will consolidate the lines, making one of the finest systems in that part of the state.

L. C. Lambert, a capitalist of Rushville, Indiana, has offered to purchase the plant of the Rushville Telephone Company, agreeing, if his terms are accepted, to expend $100,000 on the system in the next ten years for improvements.

H. Dotson has succeeded J. Johnson as secretary of the Black Hills and Spearfish Valley Electric Railway Company. He says that work will begin at once on the proposed line from Spearfish, South Dakota, to Lead and Deadwood.

Martin L. S. Mitchell, late of Grand Rapids, Michigan, is now located in Los Angeles, California, where he has an excellent position as exchange manager of the Home Telephone Company. The Home Telephone Company's main exchange, located on Hill street, is the largest exchange in the United States, no Bell plant excepted. One hundred

and fifty-eight operators are employed at main and a few less than 12,000 subscribers are handled on this modern multiple board.

C. J. H. Woodbury recently addressed the Worcester, Mass., Board of Trade on the "Telephone System of To-day." He fully described the modern telephone system and its operation, the subject being illustrated by over 100 lantern slides.

R. C. Cutting resigned his position as superintendent of the Leeds (N. D.) Telephone Company March 1, to accept a position with the Northern Indiana and Southern Michigan Telephone, Telegraph and Cable Company at La Grange, Indiana.

S. R. Robinson, who was connected with the Pittsburg-Allegheny Telephone Company, in its construction department, has resigned to accept a position with the Heeling & Ridge Company, Pittsburg, Pa., builder of telephones and other electrical apparatus.

George Griffith and Frank Canady are at the head of a stock company which has purchased of W. R. Lowe the Independent telephone system at Warren, Indiana. The new management announces that the plant will be greatly improved and the lines extended.

John S. Craven of Pasadena, Cal., president of the American Conduit Company, is enjoying a pleasure trip to Europe for a year. A. W. Buchanan, general manager of the company, at present located at Los Angeles, Cal., will take charge of the Chicago office on May 1.

S. P. Sheerin, president of the Indianapolis Telephone Company, will leave in a few days for a three months' tour of Europe. Mr. Sheerin has accomplished a vast amount of work during the last year and has well earned the vacation which he has been advised to take.

A. B. Ferdinand of Milwaukee, promoter of Independent telephone systems, has filed copy of an ordinance with the city clerk of Oshkosh, Wisconsin, which provides for granting a franchise to construct, maintain and operate a telephone and electric service in the latter city.

Judge J. N. Summers of the Ohio Supreme Court, General J. Warren Keifer and other prominent business men of the Buckeye state are at the back of a movement to organize a Telephone Users' Association at Springfield, Ohio, to combat the double telephone service.

Walter I. Mizner has been elected secretary of the Michigan State Telephone Company, to succeed E. T. Hance, who acted in that capacity for the company during its period of formation. Mr. Mizner is a son of General Mizner and comes from the American Car and Foundry Company.

Sam Byrus and S. Nichols of De Soto, Missouri, are investigating the Independent telephone situation at El Paso, Texas, with the view of acquiring the uncompleted plant of the local system. If the consent of the city authorities can be obtained, this system will probably be rehabilitated and completed.

J. W. Harper has been placed in charge of the traffic department of the Georgia Telephone and Telegraph Company. Mr. Harper has been connected with the collection department of the company since the business was started, and his services in that department led to his promotion to his present position.

President Dickson of the United States Telephone Company, Cleveland, Ohio, announces that he has practically secured $150,000 of new money for use in the development and extension of the company's lines. The new work is principally to connect the United States system, which is the largest Independent long distance system in the country, with other big systems, such as the New Independent Telephone system of Indianapolis, the Kinloch of St. Louis and the P. & A. of Pittsburg.

Harry P. Miller, manager of the Home Telephone Company of Dayton, Ohio, will be married in June to Miss Lillian Hallwood, daughter of Henry Hallwood of Columbus. Mr. Miller was formerly manager of the Central Union Company at Columbus and before that was engaged in telephone work at Springfield.

Judge Frank M. Fist of Racine, Wisconsin, has been chosen as the head of the newly formed company, which plans to consolidate the 300 Independent telephone companies in Wisconsin. Some of the leading capitalists of the Badger state are interested in this gigantic enterprise, which will carry a capitalization of from $50,000,000 to $100,000,000.

C. E. Wakeman, formerly of Grand Rapids, Michigan, has been placed in charge of the trolley and telephone line of the Evansville and Princeton Traction Company in Indiana. Mr. Wakeman has introduced a new system of telephone service. By the use of a small device the conductors of this line can telephone to headquarters from any point on the road. The telephone instrument is located in the car, and a "fishpole" is used to connect the wire with the instrument.

TRANSMITTING PICTURES AND HANDWRITING

In an address recently delivered at the Berlin Urania, Prof. Cerebotani presented an electrical apparatus for transmitting any kind of handwriting, drawing, etc. The fundamental principle is identical with the principal employed for instance by Elisha Gray, the novel feature being a highly sensitive system of electro-magnets. In the case of the drawing pencil of the transmitter being moved upward in an oblique direction, the line obtained in the receiving apparatus of previously-invented systems is a broken one. In Cerebotani's system, the electromagnets are so sensitive as to produce nearly straight lines, even in the case of their being excited by extremely small currents. The electrical transmission of pictures and handwriting, as obtained by means of his apparatus, is therefore much clearer and truer than in the case of any previous apparatus. Some samples produced by Cerebotani were transmitted from Munich to Augsburg, from Milan to Turin, and finally from Berlin to Munich. A picture transmitted some weeks ago from Berlin to Munich over a distance of 403 miles, is said to be the finest specimen of electrical transmission ever obtained in this direction.—*Scientific American.*

TELEPHONE THROUGH A JUNGLE.

The progress of civilization is shown by the completion of a telephone line through a thick jungle 750 miles wide, in the heart of Africa. It has been built by the Belgian government to enable the various Belgian colonies to communicate with one another.

The wires are strung on iron posts and on the largest trees of the jungle. Some of the poles are half a mile apart, where the wires cross a swift river or a dangerous swamp.

Posts could not be used on account of the white ants, and the large number of elephants made it necessary to keep the wires high above the ground. As storms will throw trees across the line, and wasps will make their nests in the insulators, and natives are liable to steal the wire, the Belgian government expects to have trouble in keeping the line in operation.

The El Paso County (Ill.) Telephone Company claims the largest plant in the world in proportion to the number of inhabitants served, the ratio being better than one telephone for every five persons in the territory it covers.

New Trunk Telephone Exchange in London

FOR the past few years the inter-urban or trunk lines in England have been extended so rapidly, and the traffic over them has increased to such an extent, says *Electrician*, that both the space allotted to them in the trunk line exchange at the Central telegraph office in London and the system employed there were found inadequate. The Post Office telephone department therefore decided to erect an entirely new exchange for their trunk service, and the change-over from the old exchange in St. Martin's-le-Grand to the new switch-room in Carter lane has been successfully effected.

The lines of telephone subscribers are connected to local exchanges, of which there are 66 in the London district (56 National and 10 Post Office), one large National Telephone Company's exchange and some sub-exchanges in every large town, four municipal exchanges, a few small provincial Post Office exchanges and an exchange of the National company in practically every other town of the United Kingdom. All the exchanges in the London district are connected together by junction lines, and in the same way the large exchanges in provincial towns are connected by junction lines to their sub-exchanges, but to speak from one town to another use must be made of the trunk lines of the Post Office, which connect together all the principal towns, and a large number of which radiate from London. It is not expedient to connect the trunk service directly to each of the local exchanges, and, therefore, a special trunk line exchange is established and this is connected by junction lines (frequently called trunk junction lines to distinguish them from ordinary junction lines) to all the metropolitan exchanges. Thus, between the trunk exchange and the Post Office central exchange, there are twenty trunk junction lines; to the Avenue exchange of the National Telephone Company, there are thirty; to the Gerrard exchange twenty, and so on, the total number of junction lines entering the trunk exchange being no less than 203. The demand for a trunk line is transmitted by the operator at the local exchange to an operator sitting at the record table of the trunk exchange, who notes the demand, together with the number of the two subscribers who are to be put into communicaton. She fills in a ticket with the necessary particulars, and this ticket is passed on to the operator who is in charge of the trunk line in question. The demands are taken in rotation by this operator, for at busy times of the day there are frequently several subscribers awaiting their turn to use a trunk line. When the trunk circuit is available, the controlling trunk operator obtains connection with the subscriber who originated the demand, and simultaneously requests the operator at the distant trunk exchange to ring up the required subscriber, the connections at each end being completed through the trunk junction circuits to which we have already alluded. Thus it is seen that the demand for a trunk line, no matter from which end of the line it originates, is always treated as an out-going junction call at the trunk exchange. It should be added that service or call wires are employed in connection with all the larger exchanges, that lamps are employed for all the calling and clearing signals in conjunction with a central battery system, the engaged test being also given by a glowing lamp, and that all clearing signals are automatic, so that for simplicity and speed of working

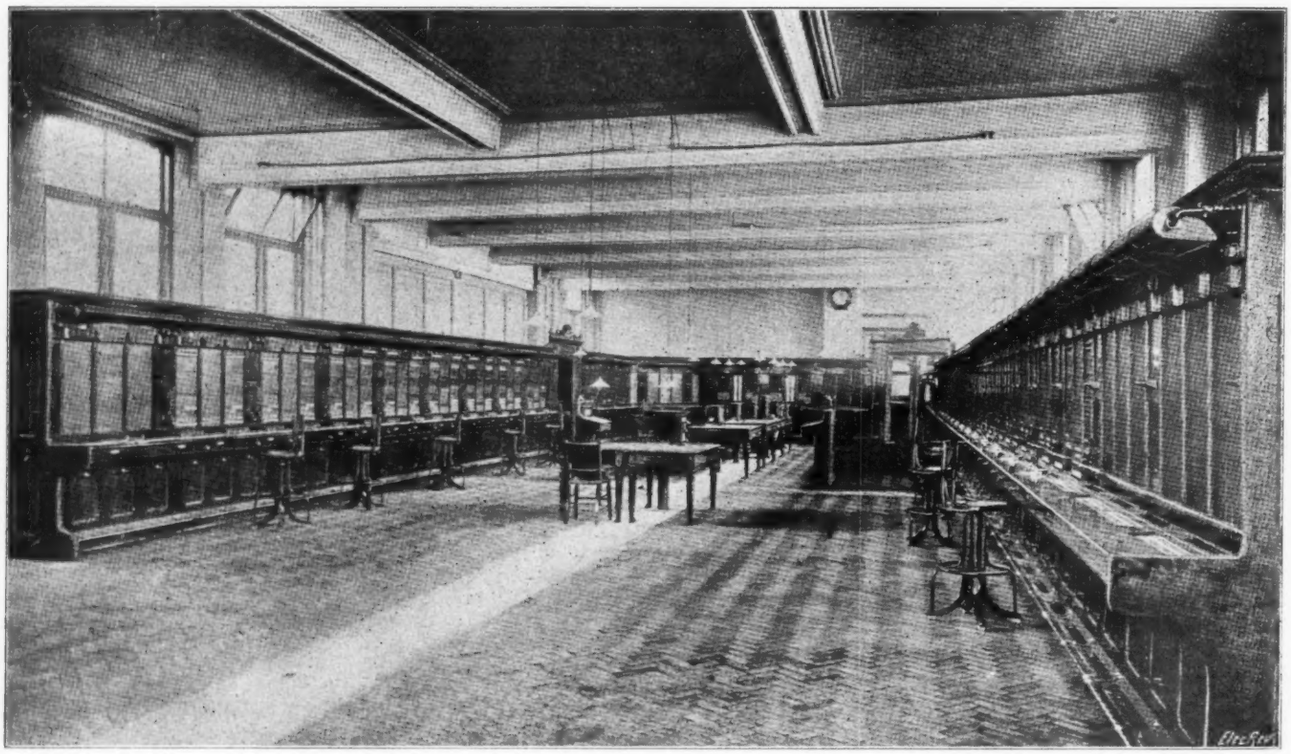
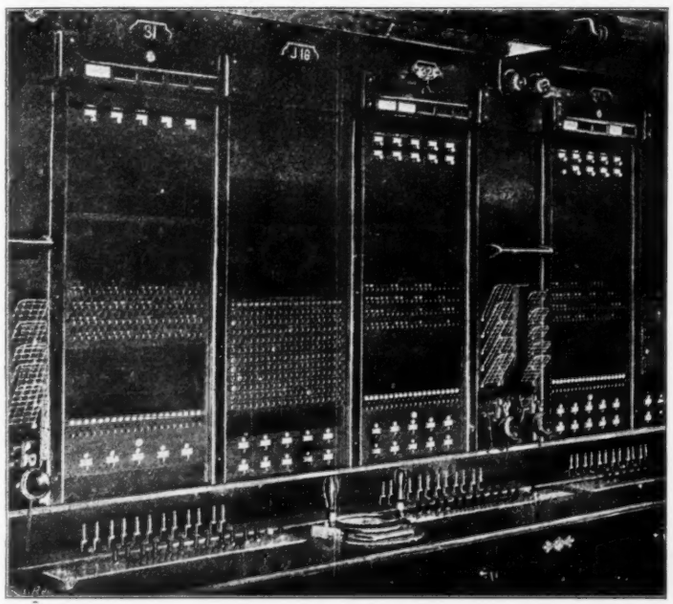


FIG. 8—INTERIOR VIEW OF NEW TRUNK EXCHANGE, LONDON.

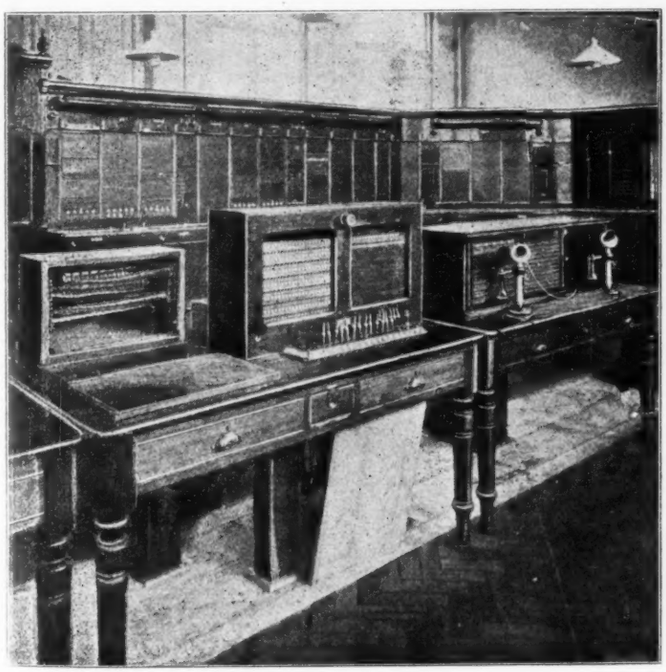
the arrangements leave little to be desired. To attain this simplicity in operation, however, a fairly complicated system of relays and other connections must be employed, the essential parts of which we shall endeavor to make clear to our readers.

Starting with Fig. 1, which shows the trunk circuit, before



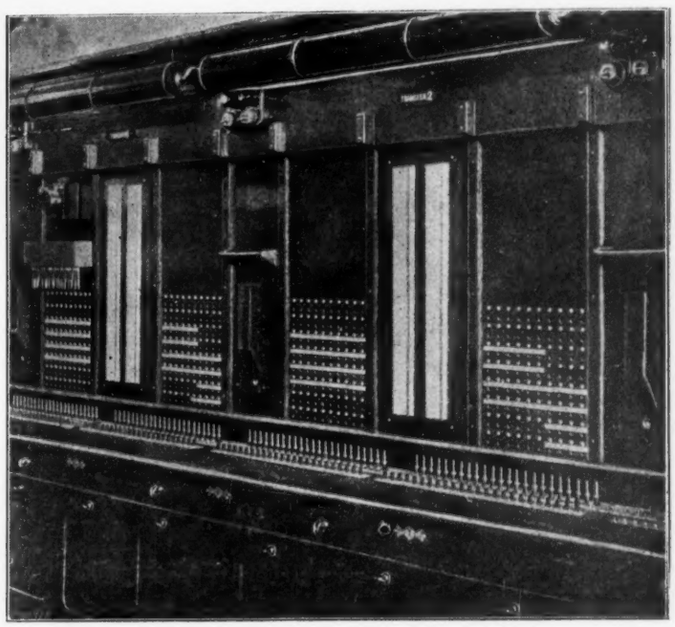
ORDINARY TRUNK SECTION.

tracing out the various connections we will first explain the meaning of the words "concentration" section and "ordinary" section. Five trunk lines are brought to each operator's position on the main switchboard. During the busy hours of the daytime, an operator is necessary for each of



RECORD APPARATUS.

these positions; during the less busy hours one operator can attend to the trunk wires of the two positions, which form together one section of the board. At nighttime and Sundays, however, it is unnecessary to have one operaor for every ten trunk lines, and means are therefore provided on certain sections of the board to take over the trunk lines from the other sections. The former sections, on which thirty trunk lines can be concentrated if necessary *(i e.,* ten in addition to the five normally worked from each operator's position) are called concentration sections, and thus at nighttime sixty trunk lines can be served by one operator sitting between two sections of the board. Each trunk line dealt with at an ordinary section of the switchboard ends at the main springs of an eight-point jack (marked 1 in Fig. 1) and is also branched to a jack on the concentration section (also marked 1 in Fig. 1), from which it is operated at nighttime. During the daytime an insulating plug of vulcanized fiber is placed in the latter, and a similar plug is placed in an auxiliary jack (No. 2) on the ordinary section. Then it is seen the trunk wire is simply through to the ordinary section, and is insulated at the concentration section. When the time for concentration arrives, the insulating plug at the ordinary section is removed from No. 2 jack and inserted in No. 1. A current then flows from the 22-volt battery (at the bottom of the diagram) through the 30-ohm coils of the pilot relays at the ordinary and concentration sec-

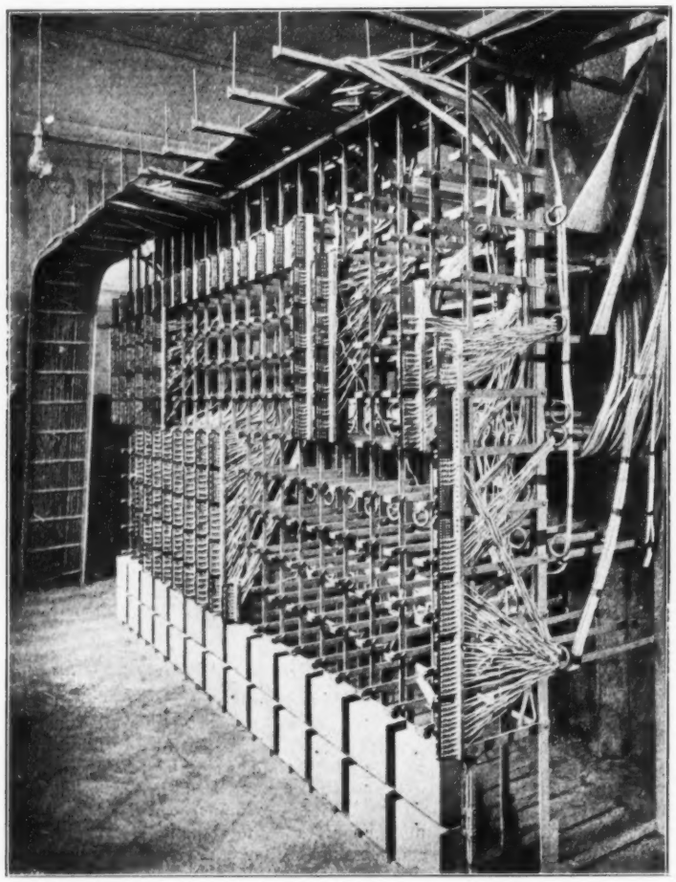


TRANSFER SWITCHBOARD, SECTIONS 1 AND 2.

tions and through the signaling lamps, shown between the jacks, to the movable springs at the side of the No. 2 jacks. Thence through the inner and long spring of the No. 2 jack on the concentration section to the long spring of the corresponding jack of the ordinary section, and through one of the inner springs of this jack and back to the earthed side of the battery. The pilot relays act at the same time in the usual manner, and the pilot lamps and the two signaling lamps glow. The operator at the concentration section then removes the insulating plug corresponding to the glowing lamps from jack No. 1 and inserts it in jack No. 2, thus restoring the signaling circuits to their normal condition, and leaving jack No. 1, which is connected to the trunk line, free for operating.

Now to trace out the course of the current during the operation of a trunk connection. Fig. 1 represents the connections of a long trunk line over 150 miles in length; in the case of shorter circuits some simplifications are introduced. In the provincial exchanges the "Polarized Indicating Relay" has been retained as an indicator as to whether the trunk line is free or engaged and to give the calling signal, but although its external appearance is the same as that of the relays on the original trunk system, it is employed in a slightly different manner in connection with two extra non-polarized relays. Referring to the left-hand side of Fig. 1,

representing the provincial exchange, normally the armature of the non-polarized relay R9 completes the circuit of a 4-volt local battery through the "Polarized Indicating Relay," P. I. R., "B" (which we will call the indicator for the sake of brevity). The needle of the indicator is thus held over to the right, indicating that the line is clear. At the same time, there are two opposing 24-volt batteries on the line, one at the provincial end through the coils of the relay R8, and the other at the London end through a double-wound



INTERMEDIATE DISTRIBUTING FRAME. TRANSFORMERS AT FOOT.

retardation coil and the inner and main springs of the jack. The relay R8 is biassed against small currents that may flow through its coils owing to slight inequalities in the E.M.F. of the opposing batteries and leakage on the line. To call from the London end, a plug is inserted in the jack and the speaking key associated with the plug is drawn forward. Placing the plug in the jack removes the 24-volt battery from the line at the London end, by pressing out the line springs of the jack; at the same time a 1,000-ohm non-polarized relay, R (Fig. 5), is bridged across the cords and when the speaking key is pushed back the operator's speaking set is also joined across the circuit in parallel with the relay.

The relay R8 at the provincial exchange is biassed against this current also; but when the trunk ringing key (Fig. 5) is pressed forward, the 24-volt battery in London is applied to the line in the reverse position to the former one, so that the batteries at the two ends are in series, and a strong current is sent through R8. This relay closes the circuit of the 20-volt battery through the relay R9 and the indicator, and it will be seen that R9 acts as a retaining relay by its lower contact. The indicator deflects to the left, and at nighttime closes a local bell circuit (not marked on the diagram). The provincial operator who receives this call inserts a plug in the jack at this end and interrupts the indicator circuit, the indicator falling to its middle position implying that conversaton is in progress. In the case of shorter circuits, the bias against leakage currents is not required, and the intermediate relay R8 is dispensed with.

If the provincial operator clears first, this connects the 24-volt battery to the line at that end, and a current flows through the relay R (Fig. 5) in the London trunk operator's cord circuits, actuating the relay R1 so that the lamp L glows. It is to prevent a false calling signal that the relay R8 is biassed against the single battery current and is only actuated when the London battery is placed in series with the local battery as explained above.

If the London trunk operator clears before the provincial operator, an indicator in the cord circuit at the latter end will be deflected. The operator will then withdraw the connecting plug, and the line indicator will return to its position to the right actuated by the local 4-volt battery, for the two 24-volt batteries are again put in opposition at the inner springs of the jack No. 1 at the London end.

At nighttime this system of permanent-current working is dispensed with, and a self-restoring indicator, telephone exchange galvanometer and ringing key are connected on at the provincial exchange in place of the arrangement described, the line being worked on the ordinary open circuit system, with a magneto-generator for ringing up from that end.

To call up London from the provincial exchange, whether

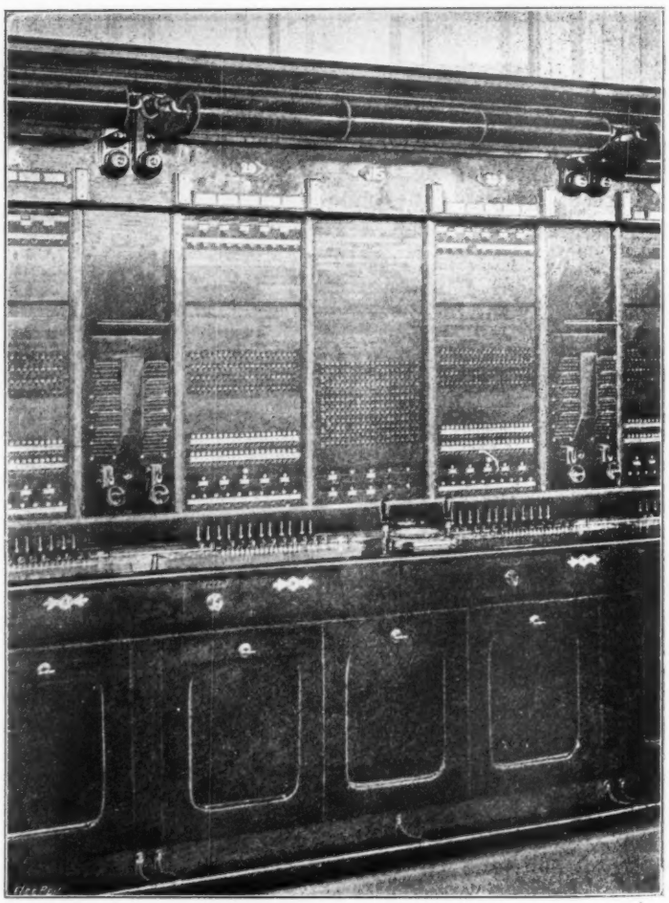


FIG. 11—SECTION OF THE SWITCHBOARD.

at day or night, a magneto ringer is employed, connected to a ringing key on the provincial operator's keyboard circuit. This sends an alternating current to the line, which actuates the 1,000-ohm relay R7 at the London end (Fig. 1), which is permanently bridged across the line through the inner springs of jack No. 1 until a plug is inserted. This relay closes the circuit of the 250-ohm retaining relay R5, and

actuates the calling lamp and pilot lamp, the circuits through the pilot relay being as usual.

We have already referred to the cord connections on the London trunk keyboard, but some further explanation of Fig. 5 will doubtless be welcomed by those who desire to study the arrangements closely. The apparatus is arranged in such a way that when one trunk circuit is joined through to another trunk circuit the connections from plug to plug are direct, and the signaling relay R only is brought into use. When the apparatus is used for joining a trunk circuit to a junction circuit the connections are completed through condensers, and further relays are brought into use for the local subscribers' clearing signals.

In addition to the signaling relays and lamps, two 3-position keys are associated with each pair of plugs and cords. The first key on the left of each pair is used for ringing on the trunk circuit when the lever is pulled forward, and for speaking when the lever is pressed back. The second key is used for ringing on the junction circuit when pulled forward, and when pressed back it disconnects the junction circuit from the operator's speaking set, as well as from the trunk circuit. This latter arrangement secures the trunk operator against interruptions from the London subscriber while she is gaining the attention of the subscriber at the distant exchange.

Normally, the relay R is operated by the permanent current battery connected at the distant exchange when the corresponding plug is inserted in the jack of a trunk circuit. The current from this battery causes the armature of relay R to be attracted; the latter actuates a second relay, R1, with which it is associated; and a lamp, L, connected in the local circuit of the latter glows. To call the distant exchange the London operator inserts the black plug in the jack of a trunk circuit, presses the corresponding 3-position key momentarily into the battery-ringing position, and then waits for a reply. Pending the insertion of a plug in the jack at the distant end of the circuit the lamp L remains glowing. When the lamp darkens it indicates that the distant operator is in attendance, the permanent-current battery being cut off when the latter inserts a plug to reply.

The clearing circuits have already been explained. At night, when the permanent current batteries are disconnected, and all the trunk lines are worked on "open circuit," the switch S is reversed to connect the generator in place of the battery for trunk calling and clearing purposes. The switch S1 is also turned to bring the retaining coil of relay

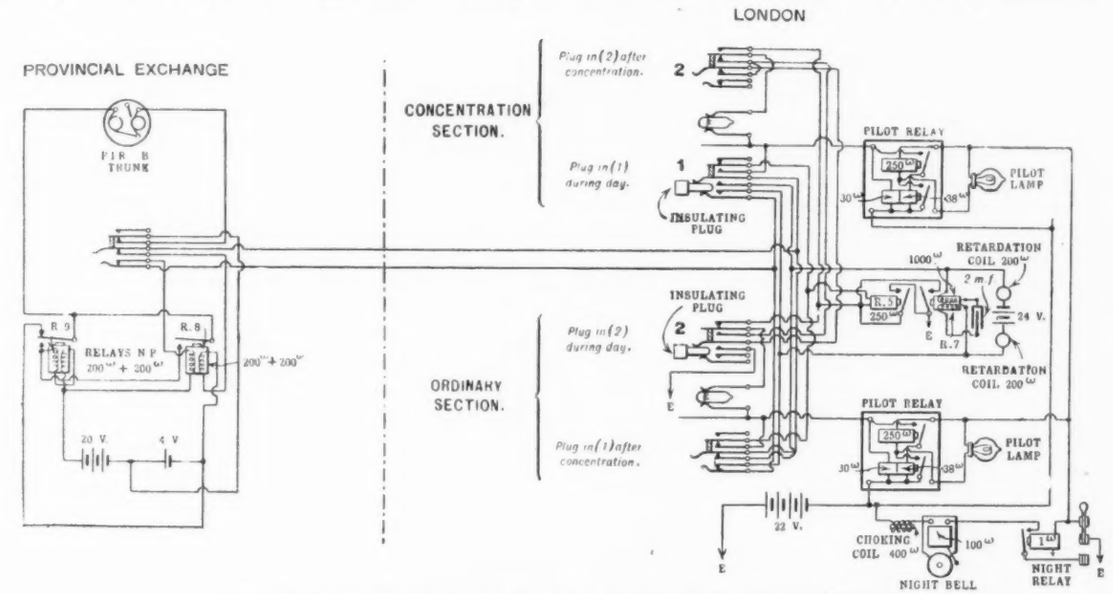


FIG. 1—CONNECTIONS OF TRUNK CIRCUITS FOR LONG LINES.

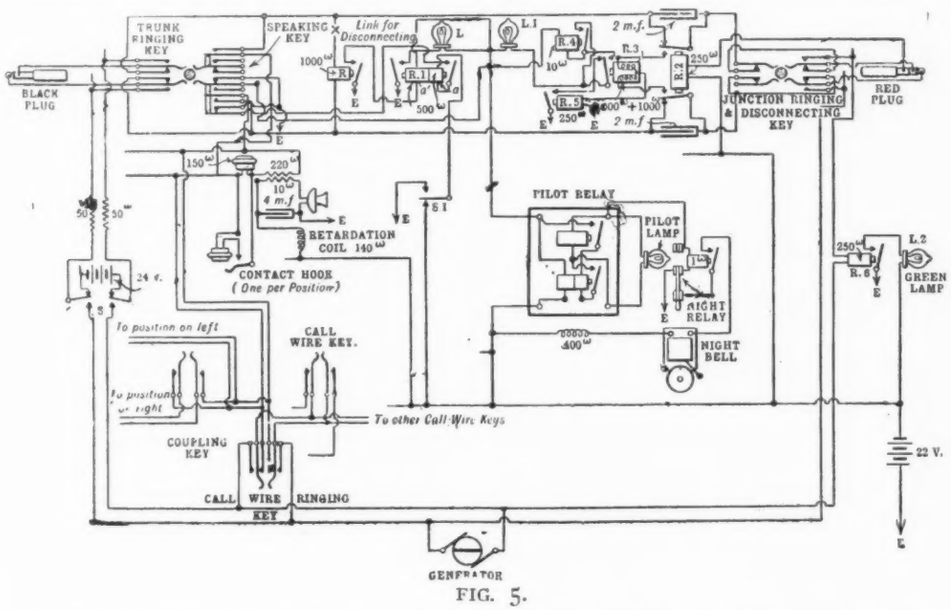


FIG. 5.

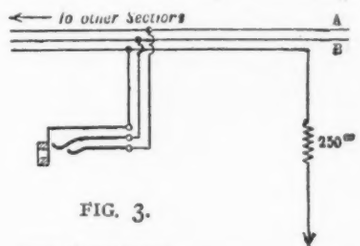


FIG. 3.

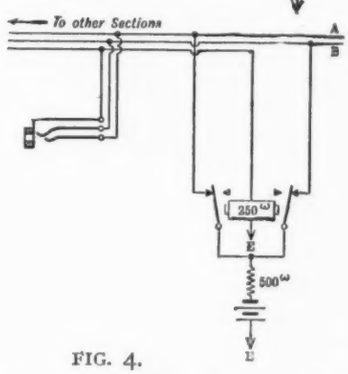


FIG. 4.

R1 into operation. If, now, a transitory clearing signal be given on relay R when the corresponding plug is in use, the armature of relay R1 will be actuated as described, and it will be held down by means of the current passing through its retaining coil. The lamp L will then glow until attention is given by the operator. When the corresponding key is turned to the speaking position, the circuit of the retaining relay is broken, its armature is released and the lamp L darkens. The switches S. S1 are not provided independently for each cord equipment, but are common to the whole exchange.

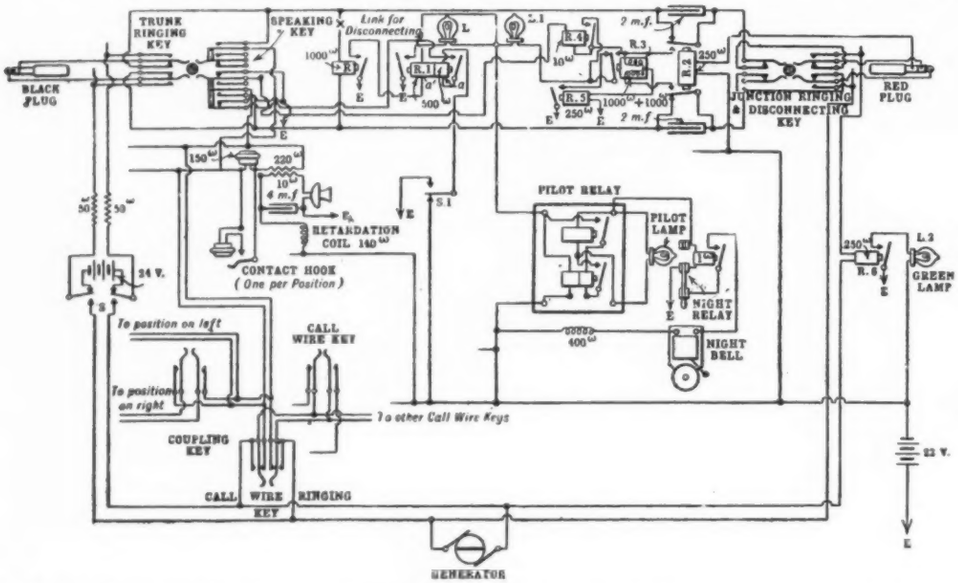


FIG. 5—OPERATOR'S CORD CIRCUITS ON TRUNK SWITCHBOARD.

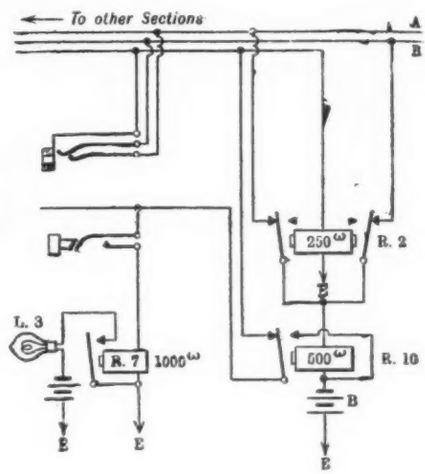


FIG. 6—JUNCTION CORD TO MAGNETO EXCHANGE

Two types of junction circuit are employed—call-wire junctions and signaling junctions. The former are employed in connection with the larger exchanges, the latter for those smaller exchanges from which there are not more than five trunk junction wires. In the case of call-wire junctions, when the call "matures"—*i. e.*, when the trunk is available to the subscriber whose demand has previously been transmitted to the record table—the trunk operator presses the call-wire key corresponding to the local exchange from which the demand emanates, asks for the subscriber, and is told by the junction operator at the other end which junction wire to employ. These junction wires are multipled over all the panels of the trunk board on simple three-point branching jacks, the bush of the jacks being connected in multiple. This third point is simply earthed through a 250-ohm resistance (Fig. 3) in the case of junction wires to common battery and common battery signalling exchanges (such as Putney, Kingston, etc.), and in the case of magneto exchanges is connected to earth through a 250-ohm relay (Fig. 4). At the local exchanges, on the common battery system, it will be remembered that a differentially wound repeating coil with the common battery in the middle is connected across the line. In common battery signaling exchanges, a relay joined to the A and B lines in multiple takes the place of the repeating coil, and in magneto exchanges a double-wound bridging coil is placed across the line and the middle point of this coil is earthed through an indicator and a battery opposing the battery in Fig. 4.

We must now refer to Fig. 5 in connection with Figs. 3 and 4. The red plug is inserted in the junction jack, and a circuit is established from the 22-volt battery through the relay R2 (Fig. 5), the barrel of the plug, the bush of the jack and back to earth (Fig. 3 or 4). The effect of this is first to open the short circuit of the condensers (so that while the plugs are disconnected from one another for battery-signaling currents they are still in connection for speaking), and, secondly, to connect R3 directly across the cords on the junction line side of the condensers, R5 being connected between the middle point of R3 and earth.

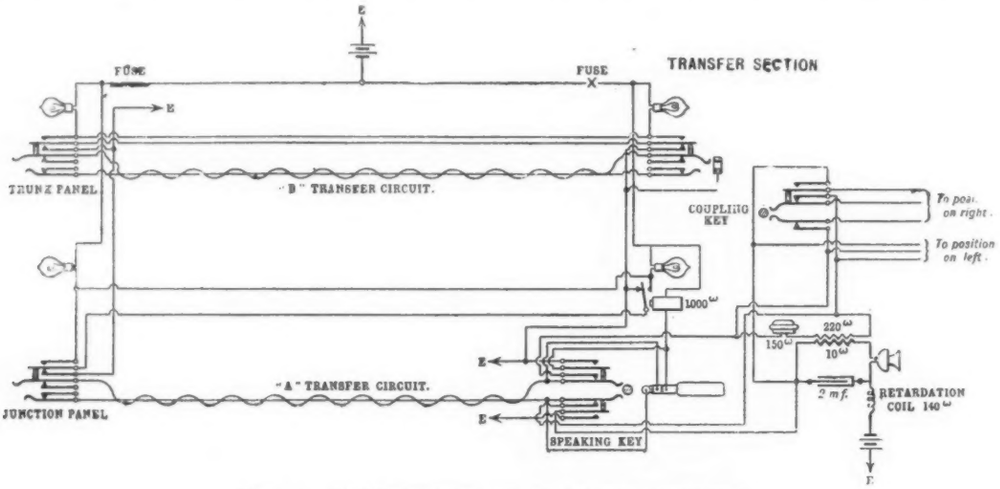


FIG. 7—CONNECTIONS OF TRANSFER CIRCUITS.

When the junction line has been cleared at the local ex-

change, the relay R5 is actuated and the clearing lamp L1 glows until the lines have been cleared on the trunk board. A clearing signal is similarly received when the London subscriber hangs up his telephone, in the case of central battery and central battery signalling exchanges, or when the subscriber to a magneto exchange rings off.

The local operator rings up the London subscriber in the case of central battery and central battery signalling exchanges, but subscribers connected to magneto exchanges

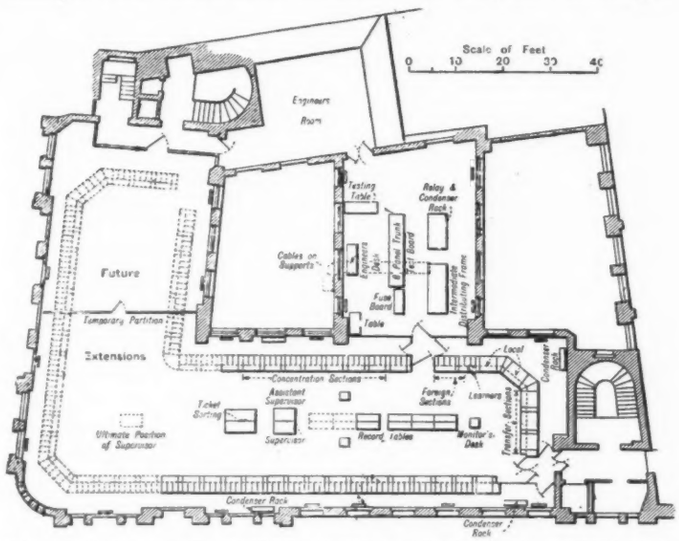


FIG. 10—PLAN OF LONDON TRUNK TELEPHONE EXCHANGE.

are rung by the trunk operator by means of the combined ringing and disconnecting key associated with the red plug. A relay, R6, in this ringing circuit causes a green lamp to glow if the circuit is in order; if the lamp does not glow one of the ringing fuses has blown or there is a disconnection from some other cause.

Signalling junctions are connected in virtually the same manner as the call-wire junction, except for the additional provision of a lamp and key for making the engaged test. The key is placed above each junction jack, and the lamp is a red lamp common to all these junction lines. In this case, also, the junctions are multipled over several sections. Fig. 6 shows the connections of a signalling junction to a magneto exchange. For central battery signalling exchanges the relay R10 and its battery are dispensed with, R2 becoming a simple relay between the bushes of the jacks and earth. The tongue of this relay is connected to the front springs of the keys; when attracted this makes contact with the connection to the bushes of the jacks, and in

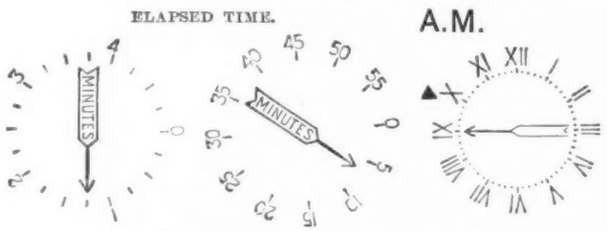


FIG. 12—A CALCULAGRAPH RECORD.

its back position it connects the common spring of the keys to the A line. For exchanges entirely on the central battery system no relay is required at all, the bush connection to the jacks and the front springs of the keys being all joined together to a common point, which is earthed through a 250-ohm resistance. The trunk operator pushes in the key of each junction in turn. If the line is engaged the lamp will glow. When she finds a free junction she plugs into its jack. This automatically calls the attention of the operator at the local exchange by lighting up a lamp, or by actuating some other type of indicator. The clearing signal is automatically sent to the local exchange on the withdrawal of the peg from the junction jack at the trunk exchange.

The transfer circuits have next to be described. To explain what these are, let us suppose that a subscriber in East Grinstead wishes to speak to Sheffield. There is no direct trunk wire, and communication has to be obtained through the trunk exchange in London. A number of A transfer circuit jacks are placed on the middle panel of each trunk switch section for the joint use of two operators, and the operator attending to the East Grinstead trunk plugs into one of these. Although these are eight-point jacks of the standard pattern, the inner springs are not employed. The plug connects the trunk operator's call circuit to the line springs of the A transfer circuit—a line leading to the transfer section or transfer board in the trunk exchange switch room—and at the same time the auxiliary side springs of the jack close a battery circuit which lights a lamp on that board (see Fig. 7). Forty-six of these A transfer lines from the various trunk sections terminate at each section of the transfer board, and each terminates at a speaking key, associated with which is a calling lamp and three-way plug, the tip and ring of the plug being connected directly to the transfer line. These are all on the keyboard shelf of the transfer board. On the vertical part of the

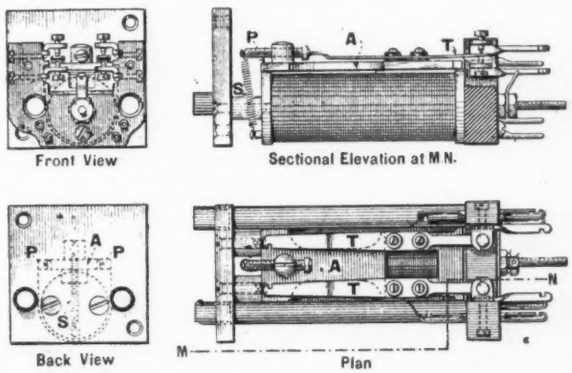


FIG. 13—HALSBY PATTERN RELAY. ONE-HALF FULL SIZE.

board are a number of jacks in which the B transfer circuits terminate, and each of these has a lamp above it. The B transfer circuits are, as it were, outgoing circuits *from* the transfer board *to* the trunk sections. The transfer operator having ascertained the demand, consults a list which tells her that the Sheffield trunk lines are on section 25 of the trunk switchboard, and she plugs the East Grinstead plug, which is opposite the calling lamp, into the jack of the B transfer circuit bearing that number. This lights up a lamp on the Sheffield trunk board, as well as the lamp over jack No. 25 on the transfer board. The lamps cease to glow when the operator at the Sheffield section replies, and glow again when she clears. On receiving the latter signal, the transfer operator removes the plug from the jack. Her duties are thus simple and almost mechanical, and she never comes in on the subscriber's line at all. The connections of the transfer circuits are apparent from Fig. 7.

The connections of the record tables are naturally the simplest of all. There are three record boards, each equipped for twenty lines. For each line there is a self-restoring indicator and a jack. The ends of the record lines at the local exchanges are brought to jacks on the subscribers' sections of the switchboards. When a subscriber desires a trunk line the local operator plugs him through on one of these jacks and gives one ring, which actuates the indicator on the record board at the trunk exchange. The record operator then plugs into the corresponding jack with a single plug connected to her speaking set, and takes particulars of the demand from the subscriber. The indicators of these boards differ from the usual self-restoring

type by the fact that the restoring current does not remain on continuously so long as there is a plug in the jack, but it is interrupted when the flap is replaced. Each board for twenty lines is served by one or two operators, according to the traffic at the time.

Having now described fully the methods in which the various connections are carried out, we come to the apparatus itself and its arrangement. Fig. 8 is a general view of the switchroom and Fig. 10 a plan showing the position of the various sections of the switchboard. The latter figure is to scale, so that a good idea of the large size of the room is obtainable. As seen, the room is L-shaped, but at present part of it is divided off by a temporary partition, and the part of the switchboard which has been erected so far is shown by the full lines. The extensions indicated by the dotted lines will be added as occasion demands. The whole length of the room on one side is taken up with ordinary trunk sections, and on the opposite side are seven concentration sections grouped together. At the end of the room the three transfer sections are placed and two local sections for subscribers with special lines for trunk service, and there are also separate sections for the foreign trunk lines (to France and Belgium) and a learner's section. In the middle of the room are the record tables, an inquiry section and the monitors' and supervisors' desks, etc. The test-board (which will be described more fully presently), the intermediate distributing frame and the relay and condenser rack are together in a separate room; and the power plant is in the basement, together with the power plant for the central local exchange, which occupies the fourth floor of the same building, the trunk exchange being on the third floor. A separate battery and charging plant, following the standard lines for common battery telephone work, is employed for signalling purposes, but current for speaking purposes is taken from the central local exchange battery.

So far as possible the frameworks of the trunk switch-

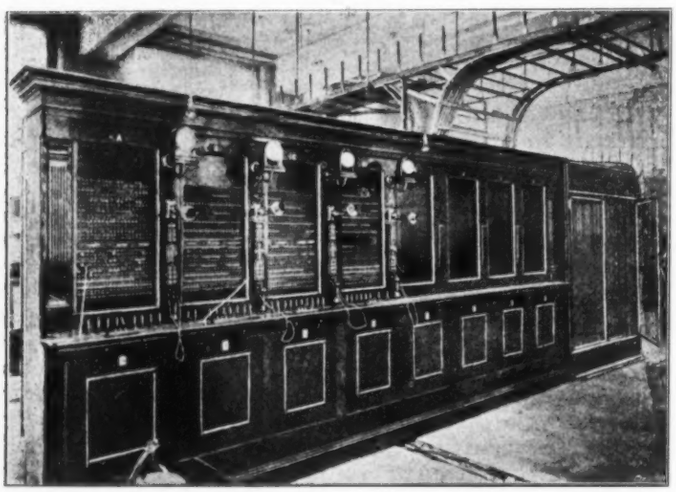


FIG. 14—TRUNK BOARD AND SWITCHBOARD.

board is of iron, and as a further precaution against fire all the wires carrying heavier currents for power purposes are in an iron trough along the top of the board at the back. Another trough on floor level carries all the trunk cables and transfer wires, and this one has a sheet iron bottom, sides of the fireproof material uralite, and engine room floor plates as a cover. The board is faced with mahogany panels, and the cabinet work presents a well-finished and elegant appearance. These panels are backed with uralite, a material of which considerable use is made in the exchange. The doors at the back of the board are of wood, covered front and back with thin sheet iron. A horizontal keyboard shelf is employed, and the lighting is, as usual, from the top of the switchboard with lamps hidden from view by reflectors which project the light on to the board.

Fig. 11 is a photographic view of one of the trunk sections, a concentration section having been chosen for the purpose. As seen, there are two operators' positions—one on either side of the central panel, on which are the junction line jacks for those junction lines which are worked with call-wires. These are in twelve rows, each containing twenty three-point jacks. The first five rows are junc-

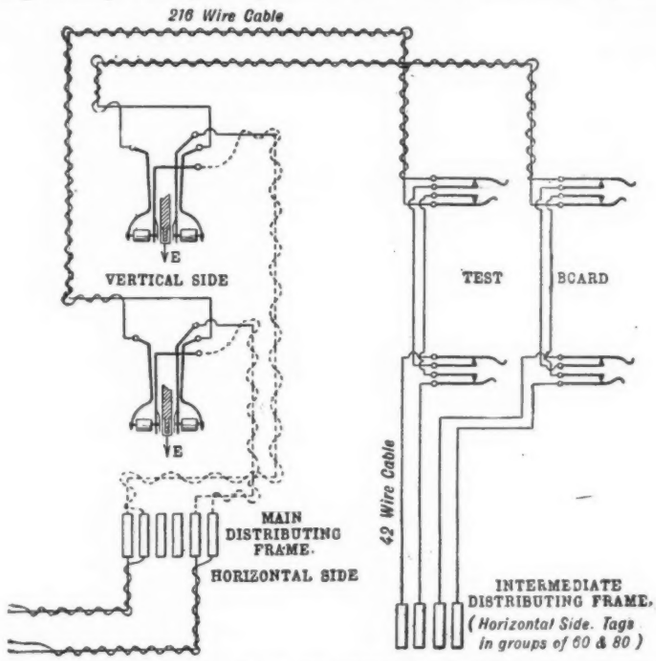


FIG. 15—WIRING DIAGRAM OF TRUNKS, JUNCTIONS ETC., BETWEEN INCOMING CABLES AND HORIZONTAL SIDE INTERMEDIATE DISTRIBUTING FRAME.

tions to common battery exchanges, and the remaining seven rows junctions to magneto exchanges. The remaining two rows are jacks and lamps connected to the A transfer circuits and to the local subscribers' section—the section to which those subscribers with special telephones for trunk working only are connected.

At the top of the trunk panel itself are the five nameplates referring to the trunk lines. In Figs. 11 these are Bristol, Newport, Ipswich, Slough and Oxford-Reading on the left, and Colchester-Chelmsford, Manningtree-Colchester, Yarmouth-Lowestoft, Caterham, and one spare equipment on the right. Just below these are the wire link-strips, which are in the circuit of the 1,000-ohm relay that is normally bridged across the line; they are taken out when the cords are tested. Then come five concentration jacks, which are normally plugged with the vulcanized fibre plugs, as explained in the first part of this article. They may be called the outward concentration jacks, by means of which the trunk lines enumerated above may be concentrated on to other sections. As shown in Fig. 11, this has been done, the plugs having been removed from these jacks and placed in the ordinary trunk jacks lower down; it was, of course, necessary that the trunk lines terminating at this section should be operated from another part of the switchboard while our photograph was being taken. The next line of jacks are the inward concentration jacks, and are associated with the bottom row of jacks. When trunk lines terminating at other sections of the board are to be concentrated on this section, the plugs from the bottom row are placed in the top row. The lamps for giving the concentration signal as described in the first part of this article are placed just above the bottom row of jacks.

In the center of each trunk panel are four rows of twenty jacks, each for the signalling junctions—*i. e.*, those for

which call wires are not employed. Above each jack is the small press button for making the engaged test, and a red lamp, which glows if the line is engaged, is placed in the center of the dark strip in the middle of the blank space above. One lamp serves for all these junctions. The next two rows of jacks and lamps are used for the B transfer circuits. Below these, in a strip by itself, is the pilot lamp, and then the five main trunk jacks with their calling lamps and the ten concentration jacks as already explained. The keyboard of each position comprises six pairs of plugs and cords, associated with each of which is a pair of keys, one a combined trunk ringing and speaking key (colored black to correspond with the black trunk plug), the other a combined junction ringing and disconnecting key (colored red to correspond with the red junction plug), and there is a clearing lamp in front of each plug. In front of these keys there are twenty call-wire keys to the local exchanges for use in connection with the call-wire junctions, an inter-connecting key on the extreme right for grouping up the operator's positions, and next to this a key colored white for ringing on the call-wires at night-time. Each operator is provided with an extra receiver for use when speaking on the longer trunk lines is faint.

Timing conversations is effected by means of a calculagraph placed on the shelf between each two operators' positions. This ingenious appliance consists to outward appearance of a clock and two handles. Inside there are three revolving discs with indices, to which are attached metal stamps, in front of which is a rubber pad. When the conversation is started, one end of the ticket upon which the particulars of the demand have been entered is placed in a slot in the calculagraph, and the right-hand handle is pressed back. This marks on the paper the impression of the right-hand dial and indices (Fig. 12), showing the time the conversation starts. A forward movement of the same handle prints off impressions of the other two dials, but not of the arrows. When conversation is concluded, the paper is again inserted and the left-hand handle is depressed; this adds the impression of the two arrows in the left-hand and middle dial, from which the time taken by the conversation can be read off. The middle dial marks minutes, and in the left-hand dial one revolution corresponds to five minutes, so that the impression in Fig. 12 indicates that the conversation was started at 11:26 a. m., and lasted six and one-quarter minutes. The principle the apparatus works on is as follows: The left-hand and middle stamp dial revolve once in an hour and once in five minutes respectively, and their two arrows revolve at the same rate and always point to the zero. At the start of the conversation the impression of the dials only is printed off; the dials and arrows continue to revolve, and at the end of the conversation the arrows only are printed, and thus the distance from the zero printed off at the commencement marks the duration of the conversation. Thus it is seen that any number of conversations can start and finish between the commencement and end of the first one without in any way interfering with the correctness of the records.

The relays employed in connection with the line and cord circiuts are (with one exception) of similar design throughout, the only difference being in the arrangement of the windings. Fig. 13 shows the construction of the relay, which was specially designed by the British Insulated and Helsby Cables (Ltd.) for the complex circuits of this exchange. The armature A is controlled by the helical spring S, and is prevented from moving in a horizontal plane by the two pins PP, thus differing considerably from the heavy armatures with gravity control employed in the American types of telephone relay. The white metal contact tongues TT are screwed to the armature, and the contact surfaces as well as the points of the contact screws are, of course, platinized. There are two windings on the coil of each relay, these in most cases having each a resistance of 500 ohms. They can thus be connected in parallel for the 250-ohm relays and in series for the 1,000-ohm relays, or they may be connected differentially. In other cases different windings are employed, having resistances as marked on the diagrams already given.

The relay and condenser rack is of the ordinary skeleton iron construction, and the intermediate distributing frame has been built to a similar specification as that for the post-office central local exchange. The frame is of iron, and the connection tags are mounted on ebonite strips fixed to wooden bases. Wire insulated with silicated worsted said to be non-inflammable, serves for cross connecting. The cables containing the trunk and junction lines enter in the basement, where they are led to the main distributing frame, which is of the usual pattern and similar to the one in the same basement belonging to the central local exchange. From the vertical side of this frame cables are led to the test-board, where they are connected to the inner springs of five point jacks (see Fig. 15). The outer springs of these jacks are connected to the horizontal side of the intermediate distributing frame, and from the vertical side connection is made through the fuse-board to the switchboard. The fuse board consists of rows of terminals, each of which is connected to a German silver spring by means of a fine wire. When a fuse "blows" the corresponding spring falls back on a contact bar; the local circuit of a relay connected therewith is closed; an alarm bell rings; and a lamp lights up at the bottom of the vertical row of terminals in which the failure has occurred. By this means the failure of any power signalling circuit is immedately brought under the notice of the attention of the attendant and quickly remedied.

Fig. 14 is a photographic view of the test-board. The five-point jacks to which the trunk and junction lines are brought are of the ordinary pattern, the fifth point (to the bush of the jack) not being made use of. They are placed at ¾ in. centers in strips containing two rows of twenty. To serve each of the four panels are six pairs of plugs and cords. The left-hand pair is connected to one of the four keys in front of the plugs, which is a simple speaking key making connection to the speaking set on the panel; the remaining five pairs of plugs and cords are not connected to any instruments. The other three keys are for ringing, one connecting to the magneto-generator, the others to the 24-volt battery and sending ringing currents in reverse directions. At the side of each panel are tablets of packs connected to the differential galvanometers on the board, and to tangent galvanometers, Wheatstone bridges and other instruments on a special testing table.

The test-board and record tables were manufactured at the post office's own factory. All the remaining plant, including the switchboards, relay and condenser rack and intermediate distributing frame were supplied and erected by the British Insulated and Helsby Cables (Ltd.) to the detailed specifications of the postoffice.

COULDN'T USE THE TELEPHONE.

The telephone booths at the Lindell Hotel, St. Louis, are not built for giants. Harry Urech, who registered recently at that hostelry from Chicago, is just 7 feet 7 inches in height and otherwise proportioned.

Mr. Urech, residing in Chicago, did not think to consider the comparative diminutiveness of the telephone booth when he gave the Bell operator a long-distance call for his home city. He made three desperate attempts to get inside the box and then gave up in disgust. The telephone boy did the talking and Urech stood on the outside and dictated the message.

Telephone Convention Papers

OUR BUSINESS RELATIONS WITH EACH OTHER.

Our business relations as Independent companies are so numerous, beginning with the city officials and continuing through the list of supply men, manufacturers, stockholders, bondholders, employes and patrons, that I know you will not expect me to discuss the entire subject at this time, and I shall be gratified if I bring out a point or two worthy of your consideration as to our business relations with each other.

You have all noticed that the subject of "Standardization" has been very prominent and much discussed recently, the Independent conventions and journals devoting much time and space to its consideration as applied to apparatus and construction, but we must admit, after hearing or reading the discussion and looking at the field of manufacturers, that such standardization will be slow of accomplishment. In the meantime can we not get together as to some standards in our business relations?

When one company gives a ten party farmer line service over an entire county for $10 or $12 per year, how long can the operator in an adjoining county expect to maintain a $15 or $18 farm line rate with service limited to one exchange, and tolls to other points? Or how long can the company that gives farmers' lines free use of an entire county expect to obtain a toll revenue from their city exchange subscribers to points within the county?

How many of us know what rate we should charge for a private telegraph wire on our toll lines, when approached by the commission or "bucket-shop" man? We naturally want the business, but there is no reason why we should not get practically the same as the Western Union, the Postal, or the American Telephone and Telegraph Company would for the same service.

We can all remember the experience of the Johnson County company at Iowa City, the Cedar Valley at Waterloo, and various other companies which raised their rates when the growth of their exchange necessitated it, but new men and new money are continually coming into the business and should there not be some means of helping them to avoid the mistakes of the early Independents, and to save them from meetings the same obstacles?

Competition, instead of co-operation, between the various interests, naturally competing with the Bell, is the most serious feature of the Independent movement, to my mind at present.

The second Independent exchange, be it "mutual" or "incorporated," invariably does more damage to the Independent cause than Bell competition. Someone is found to lose money in such a situation, and all such losses react to the discredit of all Independent investments. None of us can take the position that the last statement does not apply to us, because even if we are situated so as to finance our own town or county alone, the growth and future of our business depend on reaching out and getting connections throughout the whole adjoining territory, and this will call for additional capital each year for some time to come. I say again, we are all interested in protecting every dollar invested in Independent telephone enterprises.

These meetings are undoubtedly worth while, and it pays for us to get together once or twice a year just to get acquainted with each other, meeting the new men in the field, and to compare notes with the older ones; but if this is to be the only result, and if we are then all going back home to follow our own individual ideas again and fight it single-handed as in the past, why go through the farce of these long business sessions, pass resolutions, etc.? If that is all we want to do, a one day's session with a banquet in the evening ought to answer.

But we want to do more and we can do more by uniting and submitting our individual wishes to a majority for the good of all.

The reasons which led our forefathers to adopt a Constitution for the United States, instead of each colony following an independent flag, led them to give the National Congress jurisdiction over interstate commerce and more recently led to the formation of the department of commerce, now appeal to us; and we must get together, even if we sacrifice some "company rights," which may well be compared to the old idea of "state rights."

How much authority shall we give this association? is a question which I will not attempt to answer, but if we operators could appeal to an authoritative body of standards, with arguments to back them on the following points, it would clear the business atmosphere considerably:

1. A form of franchise for villages and cities of the various classes. The day has gone by when we should accept franchises with certain fixed rates stipulated therein, and this authority should protect us by warning new men or companies against making mistakes which we have made in the past and promoters who advocate such propositions. If rates are mentioned in the franchise, they should be on a sliding scale to correspond with the schedule which this body should fix for exchanges of various sizes.

2. Rates for exchanges in towns and cities classified somewhat as follows: 25 to 250 subscribers; 251 to 500; 501 to 1,000; 1,000 to 2,000; over 2,000.

3. A definite and simple method of determining toll line charges and, if necessary, a discrimination between grounded and metallic circuits.

4. A standard basis for the division of tolls on interchanged business, between toll companies.

5. A standard contract for the division of tolls between toll line companies and terminating or originating exchange companies.

6. A standard year mile rate for laying individual lines, also for telegraphic use of toll lines.

7. A standard farmers' contract for either switching charges, or for full subscribers' service.

The carrying out of the above would probably necessitate a Board of Adjustment or Arbitration, and this same board could probably prevent much of the uncalled for competition by third companies, if we let it be known that its object is to protect the members of this association from unwarranted assaults, and to make telephone investments more secure, but that it will also listen to complaints from patrons of its members and insist on its members giving the best service which their rates justify.

I am not here with a plan of salvation worked out and ready for your adoption, but rather with an appeal to this body for whatever assistance it may decide to give, but since preparing the paper just read, notices of the paper on "Consolidation," read by David Prewitt before the Ohio Independent Telephone Association, have been published, and I will ask you to bear with me while I read a synopsis of his paper. This appeared editorially in the *Electrical World and Engineer*, which is a high class technical journal, but does not cater exclusively to the telephone field, and its comments may therefore be taken to represent a more unbiased criticism from a business man's standpoint than some of the telephone journals:

"It is interesting and encouraging to note that the Independent telephone companies in Ohio have again drawn together and reconstituted on an active basis their association. One of the most striking things about the convention was its evident friendliness toward co-operation, and in this respect the paper presenting a plan of consolidation is worthy of note. It stands to reason that local telephone service to-day, standing by itself, is not of much account, particularly in regions with scattered population; but while recognizing this truth, the local Independent companies have often been very slow to give up their isolation and freedom. It is true that great groups have already been formed, but the subject remains a very live and pressing one.

"At the Cincinnati meeting recently a plan was proposed for organizing all toll lines and exchange operating companies. The plan is, to say the least, bold and novel. The group organization, or basic unit, would accept only such members as are not engaged in any contract which would be denied them as members. Members would be required to bind themselves to neither sell to nor enter into any contract with any telephone person, other than a member of the organization. The compulsory power of the organization should be in a body of delegates, sitting in a lower and an upper council. Each company should be represented by a delegate, sitting in both councils. In the upper council he should have a single vote, while in the lower council his vote should be in proportion to the assessed value of the property belonging to the company which he represents. This body should levy necessary taxes, the limit being fixed. The tax levy would originate in the upper council. This body should elect a president to administer affairs in vacation. No money should be paid out except by vote of the council. A referee should be elected, who would settle all controversies between members. All district organizations should be members of the central organization. Its powers should be vested in a body of delegates, one from each district. Sitting in the higher council, he should have a single vote, while in the lower council he should have a vote equal to the entire vote in the lower council of his district organization. The president should appoint with the consent of the upper council an advisory board, consisting of a director of board of trade, director of patents, director of tolls and such others as might from time to time be advisable. The director of the board of trade should arrange a place for the sale of stock and bonds of member companies. The director of patents should look after patents, to see that members are not taking liability in infringements, and also to buy any new patents of advantage. The director of tolls should

establish a clearance house to adjust tolls on messages passing from one district to another. This organization should furnish at a small profit to each member metal plates bearing the copyrighted trade-mark and the words which he would be required to place on each telephone."—*Paper read by Paul H. Patton, Waterloo, Iowa, before the Iowa Independent Telephone Convention, Des Moines, Iowa, March 9, 1904.*

THE CONSOLIDATION OF INDEPENDENT TELEPHONE LINES.

I am frank enough to say that I am not a radical on the merger question. President Herr and others seem to feel that there wouldn't be anything left of this Independent movement in about a year if we didn't all consolidate and get in a position to sell bonds and command some influence down at Boston. I am not one of those who believe that at all. In other words, I think the fact that we have succeeded, and succeeded remarkably well, has been largely because of the fact that we were composed of local institutions and that there were a large number of us. We have been built up with local capital—with our own money, or our neighbors'—and we were prevented from getting into debt because we had no credit. I think that is one of the best things that has ever happened to us. The fact that every one of these old rattleboxes that hang around on the wall, belonging to the Bell Telephone company, has a mortgage on it of $100, is not, in my judgment, a recommendation, as a successful business proposition, to the average man who wants a telephone. I question the statement that either we or the Bell Telephone company will have to quit business. There is one thing certain—if we are prevented from getting into debt, are unable to borrow any money, it will be the other fellow that quits, because he can't get us to quit. There is nobody interested in having us quit.

We have an example of the Bell's method of financing and running their business in the Michigan proposition. I had occasion to be in Chicago the other day, and had some conversation with the gentleman who handles the bond proposition of the First National Bank. He said, "You don't want any bonds," and he cited this Michigan proposition as an example. I don't know whether they are going to be able to borrow money eternally to run their business on, but as far as I am concerned, I don't have any special fears of the future, because the fact that the men who have gone into this business and made it a success is the best evidence in the world that they have brains enough to do anything that may come up in the future.

Now as to this long distance matter. I am a believer in it, but there are about three kinds of toll business that we want to recognize as being essential to a successful telephone plant, and my experience is that about fifty per cent of the toll calls that pass through exchanges begin and end within the county lines. That seems to me to be purely local business. Probably 25 per cent doesn't go beyond the adjoining lines, and that is practically local business. Now, then, there are a few times that we want to talk to Chicago and St. Louis and Kansas City and Omaha, and somebody else has got to take hold of that and handle it. Just how that is going to be worked out, I don't know. I undertake to say that a line without any stations on it, that could be built and placed on the poles at a reasonable price, on the lines running between here and Kansas City and St. Joseph, would be a good investment, because there is local business enough between the city of Des Moines and Kansas City and St. Joseph to pay. It probably would not pay as an Independent proposition, but it would pay if it did not cost anything but a reasonable rental for space on the poles and the copper that it takes to build it. We have two companies branching out from Kansas City to Des Moines, and the two together can easily arrange to give us a through wire.

I suppose most of you gentlemen in the telephone business were compelled to go into it, just as I was. We had to have an exchange; somebody had to build it; and we built it. I am not dissatisfied with the investment. We have developed our toll business locally until it is at least satisfactory, and that can be done, gentlemen, with iron lines and iron wires better than with copper, because it is not so expensive and does not give half the trouble. But when you go to talking about 150 to 1,000 miles, you need copper and a different kind of construction.

I am not in favor of and don't believe we are to-day ready for general consolidation. We want general co-operation, we want confidence in each other, and we must have it. Some time in the future—in some way, by some plan yet to be determined—it may be found necessary to consolidate all these local companies. I don't know about that, yet I am frank to say that I doubt it. The very fact that we have succeeded and are satisfying the people is the best evidence that we don't need it, to my mind. This small amount of business that goes to Chicago and Kansas City and other places, that might properly be termed "long distance" is a very small affair with us. The business that we need, that is paying us and giving us a right to be here, is beginning and ending within fifty or seventy-five miles of your own exchanges, and it is usually the most important part of the telephone business.—*Address by J. S. Bellamy, Knoxville, Iowa, before the Iowa Independent Telephone Convention, Des Moines, Iowa, March 9, 1904.*

THE CLEARING HOUSE AS CONDUCTED IN MINNESOTA.

The clearing house subject is one that was first brought to my attention by the president of the Minnesota Association. The state was dividing its moneys similar to the manner now in vogue in Iowa, seldom getting settlements. Finally the question came up as to how it could be better handled. I took the matter up and divided it into two parts. The clearing house is a very small portion of the work. The clearing house in this department is the same as the banking clearing house, and only attends to the handling of the money at the end of the month, after the amounts have been arrived at for each company; and the transfer of money is greatly lessened by clearing. The other department is an auditing department, in which we have a uniform auditing of all accounts. I have heard the gentlemen here discuss the subject of doing away with a number of managers and getting into a uniform way of doing business along one line. The same idea is carried out in the clearing house. You have fifty or a hundred companies represented; you have fifty or a hundred different ways of auditing—of getting at the totals of your messages and at your collections. Thus you certainly lose, and lose between each other. In the auditing of the accounts we have the one system—the message system—in which we use the message blank. This message blank is used at all switching points and at the terminals of the message. These are carefully audited, and each company is assigned its portion after the originating fee is deducted from the total of the message.

You will say, of course, that this would come only after using the toll basis and the other divisions. In what other way will the clearing help your people? In the collection department. The message, we will say, originates at one of your western points for Des Moines, or Des Moines for a western point. It passes over five or six different lines to get to the objective point, and the man here refuses to pay for the massage; he says he never received it. At our place we trace this message to all points, and then if the gentleman does not say he accepts that, we get letters of collection. We have numerous little ideas in the clearing that only can come to you as you get into the work and use the clearing; but the uniformity of auditing is its principal feature, and it can be done for much less than you can audit yourselves. You check with the man who connects with you, and if your message goes on to the next man you have it checked there, and you have to check a third report. If there are a hundred companies connected, you would have to check sixty or seventy reports, at least. In this way you have but one report to check, and that is your own, the other having been checked and divided for you.

The clearing house in Minnesota has certainly given the greatest of satisfaction, and the one great thing that it has done is, that it has tended to bring contentment or a trustfulness between the companies, which now realize that they are getting their just dues, and that their neighbor is not getting more than should be apportioned to him, nor more than he is rightfully entitled to. In our clearing house we check the business between stations of the same company. Many of the small companies have a central office for a number of little towns. There was one that had sixteen towns. The manager decided that he could check his own business, only the business that was interchangeable going into the office. His exchange was located a little to one side of the midway point; he had a smaller number of offices toward the main line, where they connected. The first month, out of 287 messages that were interchangeable they had lost track of ninety-six. The next month they knew nothing of 104 out of about 300 messages. They at once decided that the idea of trving to have a groceryman or a druggist—whoever happens to handle their business at a toll station—try two systems of reporting would not do. As it is now, the minute our operator rings, it rings a drop. We have a third ticket beside the through ticket, which registers. The operator comes in on the line and hears this man calling a second, and makes a ticket of it. Any time one of the stations on your line rings, it rings the drop in the exchange; and when the girl comes in on the line, if she hears them ringing the A and B, she takes a copy of the message, saying nothing. Any operator that is on the board has sufficient time, and she can make the checks just as fast as anyone will talk. The checks do not require particular writing—simply facts. It is very abbreviated, and can be taken down while the operator is answering other calls.

Our clearing house operates successfully at the present time in Minnesota. In the northern part of the state there are eleven companies connected to the Twin Cities. The toll lines radiate from the Twin Cities. We have no trouble whatever. Last month we had only eighty-six messages to look up outside of one style of messages, which gave us a great deal of trouble. For instance, Des Moines calls a point east of here, saying: "This message is to be reversed." The operator there takes it up and accepts the charge. In that case, of course, the other end is the originating end of the message, but the girl at that point very often forgets to make an outward message of it, or a reverse message, and we had, last

month, something like $30 worth of messages that we had to look up. When we first started, the losses were terrific, both ends reporting an inward message.

At the start the work was done under contract, but I found that very unsatisfactory, for the reason that the small company thought the larger company was getting more than its proportion, and they now pay proportionately to the number of messages handled. At the end of the month the amount is divided, and each one is charged according to the messages handled for it. The charge varies. The business in Minnesota is much smaller than in Iowa, because the towns are much smaller there than here. I think for last month the cost was about 7 per cent on the gross. That includes all printing and everything. They make no report sheets; they make their report on a ticket for each and every message. We will take an office of the size that would handle thirty messages in a day. They use a blank or an office record that gives them a copy, practically, of the ticket. This is taken up by the operator the next morning, after the tickets have all been gone over thoroughly, and before her business commences for the next day. We settle from the 20th to the 20th of each month, for the reason that a great many of our station agents are in grocery and drug stores in towns. On the first of the month they are very busy at their own businesses, and are in no position to attend to our tickets. When we call them up on the last day of the month and say, "Please send our tickets tomorrow," we don't get them for several days, and we don't get our reports out until the last of the month. On the contrary, when we call them up on the 19th we get our tickets immediately.

The only dissatisfaction we have ever had from the work was that the smaller man thought that the larger one had a benefit when there was a contract in it; but now we have it down to the point where everybody has an equal right in the matter. Then there is an arbitration board, to which a man who doesn't think he is getting sufficient mileage may make complaint, whereupon the board will investigate the division. The United States system uses this mileage basis that I speak of, and 25 per cent is allowed as originating fees. It is the same clearing house system that is used so successfully in both Pennsylvania and Ohio.—*Address by Mr. Brookings, of Minnesota, before the Iowa Independent Telephone Convention, Des Moines, Iowa, March 9, 1904.*

JEALOUSY AMONG TELEPHONE MEN.

The subject given me is "Jealousy Among Telephone Men." I will venture just a few remarks along this line, and will say that when I first started in the business I was very jealous of a good many men who were starting out about the same time; and jealousy in this business, I find, is like that of almost any other subject out of which jealousy grows—caused through ignorance. We are all ignorant and inexperienced at first, and what we think is being done to us by our fellow telephone men to harm us, we find is only that which they are doing to assist us. Now, as we become better acquainted with each other and with the requirements of the business, this jealousy disappears and a feeling akin to fraternity exists. I am glad to see that displayed here; I am glad to see it displayed among my more intimate associates. I think jealousy is something that does not stand very much now in the way of the Independent movement. It is not to be considered, perhaps, as anything of very great importance, because as we grow old in this business we become more satisfied and convinced that to associate together and to become better acquainted with each other is to become educated; and as we become educated we prosper and improve.

There was a time when every man seemed to think that he wanted to cover all the territory that adjoined him, and if somebody else got to work in that field he became jealous of him, and from that jealousy there sprung up a strife which resulted in a certain measure in competition; that is, men would vie with each other to see which could do the most for his subscribers and give the cheapest service; and the result to-day is that we have been losing money, some of us. The question now is—how can we get back to make money out of our investments? You have made mistakes and want to correct them. Now, through jealousy or strife you never can do it; but by working heart to heart and hand to hand, admitting our mistakes and going about to correct them in a business-like way, we may accomplish that end, which will result in establishing an Independent telephone system that will be a mighty competitor of the Bell company; that will not be run on sentiment, but on strictly business principles.

When the farmer started to build in our territory we became jealous of him, and we thought he had no right to do it. When we started in business the Bell people became jealous of us—we were infringing on their rights, they asserted, or conflicting with their business interests. But now, laying aside our jealousy, we must recognize that the farmer has a right to build a line if he wants to, and provide himself with any service that he is satisfied with; and the Bell has recognized that we have a right to go into the telephone business. The man who will succeed is the one who renders satisfactory telephone service and pays a dividend on his investment. The company that will succeed in the telephone business, to my mind, must be the company that renders the best service to the people who use it and who are willing to pay a price for it that will pay a dividend on the investment. Now, then, in order to do that, we must unite our interests and our efforts—not combinations or mergers, perhaps, at the present time, but we must unite and meet here as a body of directors that will determine the policy that will bring about the best results. And we see now, every one of us, the lack of organization and unity of action in our affairs.

We blame the farmer for building. Do you blame him when you consider the propositions that he has had presented to him? As many faces as we see here, we find that just that many propositions have been presented to the farmer. Why wouldn't he conclude that he knew just as much about the telephone business as we do? But how would it have been had we posted up on the subject, organized and met as a board of directors of one large company, or by delegates to a board of directors, and had a well-defined, equitable policy, so that we could all have come out and offered the same proposition to the farmer? It would have presented a different aspect to him. I say that the trouble with us is a lack of organization and knowledge of system and of business principles. We have to learn this by experience. All jealousy should be dismissed at once, and when one man has an idea, let's consider it and see whether or not it has merit in it. If there is merit in his ideas or in his plans, then let's adopt those which seem to be the most advantageous to our interests, and instead of trying to head off some man who has a plan or a scheme or a problem that he thinks he can solve, if it is a good one, let's indorse it and go ahead.

It seems to me that the immediate demand of the future is that the Independent people of the state of Iowa, or any other state, should begin at once to get ready to go into the telephone business on a more comprehensive scale. We have been experimenting; we have spent large sums of money; and now let's arrange our business affairs so that we can go into a business that will be productive to capital, because we must satisfy our stockholders. It seems to me that there are too many managers of telephone business, and if we can consolidate our interests in some way so that we have fewer, or not such a multitude of managers, and provide long distance connection, then we will become a system that is, in fact, a real competitor to the Bell company.

There is neither sense nor business judgment in our going out and trying to corner the telephone business, and doing it at a loss. The business way to do is to capitalize and establish a plant and pay dividends. That result attained, we all come down on a more friendly fraternal basis, and all jealousy is dispelled, because we all have those troubles of our own—they come home to us seriously—and that being the case. the subject of my paper would be very state.—*Paper read by H. E. Ralston, Maitland, Mo., before the Iowa Independent Telephone Convention, Des Moines, Iowa, March 9, 1904.*

A JUDGE'S ESSAY ON THE TELEPHONE.

The telephone is one of the commercial activities against which the writ of injunction is seldom sought. The reason I suppose is that it works but half the time and no living mortal has yet been able to tell when that time is. For a like reason I have never known of a writ of mandamus to issue against it, for all powers, human and supernatural, are unavailing when it refuses to perform its expected and guaranteed functions.

I presume the reason why the companies comprising this association are all generally known as mutual is because of the frequent heroic efforts of both parties to talk while the instrument itself renders no assistance whatever. As one boy said to his playmate, "We have got a telephone at our house and you hain't." "No," said the other, "but my pa has got a balky horse."

The word telephone is derived from two Greek words meaning far off and sound. I have seen times when I have attempted to express myself in Greek. It was long ago observed that "Neither the naked hand nor the understanding left to itself can do much; the work of the world is accomplished by instruments and helps."

Physical energy, with the aid of all the many devices and forces that the inventive genius of our years has designed and mastered, has in a startling and marvelous degree increased the product of earlier days. Intellectual power by the same assistance reaches over and beyond the limits of individual effort and learns the wants and desires of a nation and a world with greater ease and certainty than our fathers gained equal knowledge of their nearest neighbor.

These agencies of service have so completely brought within their direction and control the forces of production and distribution that the social and political world has been modified and even re-constituted, and the future will doubtless bring us even more surprising and remarkable changes. By them that which was impossible yesterday becomes potential to-day, and the day dream of the present becomes the reality of to-morrow.

It was to Joseph Jenckes of Lynn, on May 6, 1646, that the General Court of Massachusetts, under the system of law called the "Body of Liberties," gave the first patent ever issued in America. This device was a scythe used to this day and since appropriated by "Father Time" as his own peculiar emblem.

From that day to this, those men who designed the various instruments of service were, many of them, born poor, lived poor and died poor. They were accorded little honor, while entitled to great ones.

To my mind every man owes some debt to the future, for in the general civilization of the world we are all first recipients, and then in turn should be benefactors. Each day and generation makes its successive special contribution. In our day we are offering to the world's progress a large part of its instruments of service.

Next to ability to design comes the ability to make the things designed accessible and useful to the general public. This I understand to be your work. It may be conceded that the motive which prompts is the legitimate one of gain, but I beg to remind you that no man or company of men ever yet performed a public service and was able to retain all the beneficent results. We shall never know how much the spirit of self-glorification may have actuated the men of early days, many of whom are now called great, but the states they founded, the laws they passed, the art and literature they encouraged and protected have been for the benefit of all mankind in every land.

In my analysis and view, the recognition of two propositions are not only largely contributive to your success, but have indeed been the cause of your existence. The first is that the public not only wants and appreciates, but is willing to pay for excellence of service. The second, that there is a limitation which must not be exceeded, and that is that society in its entirety shall not be compelled to pay for this excellence to some of its members an artificial price for their productions which has but little if any reference to the cost. Upon these propositions and the questions growing out of them are based many of the problems which are to-day interesting and even disturbing the public mind.

I have such faith, however, in American intellect and American enterprise and character, which has never yet found itself unequal to its task or purpose, that I believe it will not invite the "wasting of indolence" by encouraging the belief that we are now all that we should or can be.

Because it befits your past achievements and is in harmony with the spirit of your purposes, I beg to offer you the sentiment of an old Latin maxim, *Nec timeo, Nec quieto.* Neither fear nor rest.—*Address delivered at the Banquet of the Iowa Independent Telephone Convention, Des Moines, Iowa, March 10, 1904.*

TOLL LINE ECHOES FROM RURAL DISTRICTS.

Warroad is to have a telephone system and a pop factory. *Fargo (N. D.) Call.*

A farmers' telephone company is wanted out of Omemee. —*Williston (N. D.) Graphic.*

Guy Gay is the night operator at the new telephone exchange.—*Fullerton (Neb.) Journal.*

Will Pollard has a new telephone in his residence.—*Pushville Items in Franklin (Ind.) Democrat.*

John Hall drew telephone poles for the new line at West Pine River last week.—*Alma (Mich.) Record.*

The central telephone office at Rush Hill has been located at Mrs. Green's Hotel.—*Mexico (Mo.) Ledger.*

The Gallipolis and Crab Creek Telephone Co. have their line completed.—*Point Pleasant (Ohio) Register.*

A new farmers' telephone line is being talked of in these parts.—*Genesco Letter to Dysart (Iowa) Reporter.*

Louis Hansen has put in a new 'phone out to his house, three miles north of town.—*Aurora (Neb.) Republican.*

The Stewart telephone line will be built as soon as the farmers are through sowing oats.—*Champaign (Ill.) News.*

Fred Pope and Roud Herron were at work on Ralph Brown's telephone line last Thursday.—*Manchester (Ill.) Star.*

Woodston will have a telephone system, and wouldn't that jar you?—*Grand Branch Items in Atchison (Kan.) Globe.*

Well, we have the poles up for the telephone line. It will soon be hello.—*Scudder Correspondence in Celina (Ohio) Democrat.*

The Piqua Home Phone Company is experimenting with a new box designed to prevent eavesdropping.—*Covington (Ohio) Gazette.*

The Good Hope Telephone Co. have set posts in this immediate vicinity and hope soon to run the wires.—*St. Charles (Mo.) Banner-News.*

We have R. F. D. now. What we need next is a telephone and then we will be right in town.—*Walton Notes in Charlotte (Mich.) Republican.*

It is stated that Tom Allshouse, of the Steele Telephone Company, has offered to run a line to Dawson for $100.—*Grand Forks (N. D.) Herald.*

Twenty-eight lines have hooked on to the new telephone switch board at this place. The telephone rate will be 25c per month.—*Holgate (Ohio) Review.*

The Russell telephone line also seems to be enjoying an abnormal growth. Twenty new telephones have been put in during the past two weeks.—*Holgate (Ohio) Review.*

The Valley City Telephone exchange shut down for a few minutes last week because of a lack of electricity. It was the first break in seven years.—*Grand Forks (N. D.) Herald.*

A new telephone company will connect a line with the Buffum board at Vandalia. Boys, when you complete your line call up "Jack and Jill."—*New Harmony Notes in Louisiana (Mo.) News.*

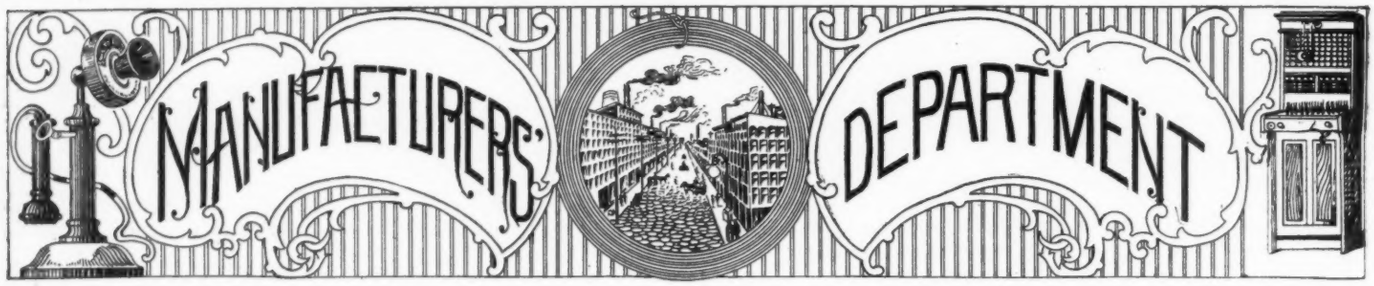
A new telephone line has been erected in our vicinity starting at W. J. McEndree's and passing by his father's place, thence to Mrs. Hattie Davis'.—*East Durham Events in Dallas City (Ill.) Enterprise.*

Miss Emma Beier relinquished her position at the local telephone central on the first of the month and will—oh, you can guess the rest. Miss Madaline Brownfield now answers the "hellos."—*Cooperstown (N. D.) Sentinel.*

The lightning struck one of the poles of our rural telephone line Tuesday night, damaging the pole and breaking an insulator and the wire. Telephone service was not interrupted, however, as the ground acted as a return conductor.—*Ayres Letter to Marshall (Mo.) Index.*

A meeting to discuss rural telephones was held here Sunday. The committees propose to run the telephone from Anton Pille's to the town, and extend north. Arcadia has been behind the times long enough. "Let us then be up and doing," etc.—*Arcadia Letter in Carroll (Iowa) Times.*

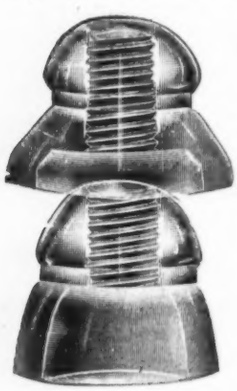
A meeting of those interested in the extension of the telephone line from Huntsville, Wash., up Sorghum Hollow, was recently held, and they decided to at once construct the link, which will be about four miles north from Huntsville, and will accommodate several farmers. The cost of these lines, including wires, 'phones and labor, will not be over $150. There is also a line connecting with the Whisky Creek section.—*Electricity.*



1848—THE STORY OF HEMINGRAY SCREW GLASS INSULATORS—1904.

Among the manufacturers of screw glass insulators in the United States, the Hemingray Glass Company of Covington, Kentucky, stands as a pioneer, whose goods for scores of years have successfully stood the most severe tests, and at the present time are in use in all parts of the United States. When it is taken into consideration that the Hemingray Company was established in 1848—more than half a century ago, beginning the manufacture of glass insulators at that time—it can be readily understood why the product of this concern is so well known throughout the country. In the fullest sense have its insulators been "time-tried and fire-tested."

In 1870 the business was incorporated, since which time it has increased its output each year and made marked improvements in the class of goods manufactured. At the present time the claim is made that the Hemingray Glass Company is not alone the largest establishment of its kind in the world, but that its yearly output and sales are more than those of all the other insulator manufacturing industries combined. It manufactures annually many millions of insulators, all of which find a ready market. The factory at Muncie, Indiana, is kept running day and night, but even with the plant working to its outside limit, the company reports that it is behind in its orders. The offices of the concern, at Covington, Kentucky, are a busy hive of industry.



The Hemingray Company manufactures more than thirty different types of high potential insulators, all with "patent drip petticoats." The points or teats on the lower rim of the "petticoat" attract the water on the outer and inner surfaces of the insulator into drops. The drops from these points fall on the cross-arm, thereby preventing the moisture from creeping upon the insulator, and thence to the pin. It is claimed that they have given the best satisfaction of any insulator ever designed for the purpose. The company also makes several varieties of insulating or break knobs, electric light globes and battery jars.

It is the proud claim of the Hemingray Company that to the superiority of its insulators, more than any other agency, is due the marvelous success of high voltage power transmission. The reasons it advances for this cover all the cardinal points in the case. Primarily, perfection of manufactures leads the list, and is given the credit for being the chief feature in winning success in the insulator market. Perfect design, uniformity of quality, and mechanical and electrical strength are also named as leading points of merit in its goods. It has been the one aim and constant study of the Hemingray Company not only to improve its insulators wherever possible, but also to obtain the highest degree of electrical and mechanical perfection in the construction of the same.

One of the leading insulators manufactured by this company is the "Provo"—its standard type for voltages of from 10,000 to 50,000. It is furnished in several types. The "Provo" insulators were named after Provo City, Utah, where the main generating station and offices of the Utah Department of The Telluride Power Company are located, and where the insulators were first used.

Another insulator of still greater voltage carrying capacity is the Gerry 55,000-volt type, known also as the 9-inch Muncie type. This insulator is used on the high voltage transmission between Canyon Ferry and Butte, Montana. It is all glass, non-cemented, and it is claimed for it that it has carried as high as 57,000 volts.

A high-tension insulator made by the Hemingray Company recently stood a test of 120,000 volts without a breakdown.

Speaking of its insulators in a general way the company in its catalogue says:

> Our experience in the manufacture of insulators dates from their earliest use. We have a very extensive equipment for this work, and our factories are advantageously located in the natural gas district. High voltage insulators are given especial attention both as to the quality of glass, and the process and length of annealing.
>
> Not the least important is the careful selecting and packing of high voltage insulators. Many times insulators are delivered to the customer which were never fit for use, or arrive in a thoroughly unfit condition. We have been many times complimented on the even grade of our high voltage insulators and the apparent care that was exercised in the packing and shipment.
>
> We will be pleased to furnish on request, full information regarding other manufacturers' statements of measurements on our insulators.

Nearly 100 big electric railway, power and lighting companies throughout the United States use the high potential insulators manufactured by the Hemingray concern, besides scores of smaller companies. The four highest voltage plants on which the "Provo" insulators are used are: The Telluride Power Company, The Logan Power Company, The Power Company and The Kalamazoo Valley Electric Company, all operating at 40,000 volts or over.

Catalogues, price lists and any other information desired will be furnished on application.

PROSPEROUS CALIFORNIA EXCHANGE.

The Home Telephone Company of Los Angeles, Calif., has just issued an official statement showing that it has now installed and in operation 11,747 telephones, as compared with 8,415 when the plant was taken over from the construction company last October. The authorized capital stock of the company is $3,000,000, with an authorized bonded indebtedness of $2,500,000. The company also announces

that it has secured, for itself and affiliated companies in Southern California, the exclusive right to the use of the automatic telephone, and has entered into a contract with the Automatic Electric Company to install in the near future a new station on Grand avenue, in the southwestern section of the city, with 4,000 automatic telephones. It will be followed immediately by similar sub-stations at East Los Angeles and Boyle Heights.

LATEST DEVELOPMENTS IN SELF-RESTORING DROP SWITCHBOARDS.

Among the latest developments in self-restoring drop switchboard equipments is the new wall style board designed for small village exchanges and country party line connecting stations, which was recently put on the market by the International Telephone Manufacturing Company, Chicago.

The board, a front view of which is shown in Fig. 1, is regularly made with an ultimate capacity for twenty-five lines. The cabinet work is of neat design and is built of finely finished, quarter-sawed oak. The top of the plug board is covered with heavy belt leather, one-eighth inch thick. The cabinet is mounted on a back-board, to which it is hinged with four heavy brass hinges.

FIG. 1.

The transmitter is mounted with a regular telephone arm on the top panel of the front of the board. The inside of the cabinet is divided into three parts. One partition is placed immediately back of the key shelf and serves as a terminal board for the cord clips. Underneath the cord terminal board is ample room for the proper length connecting cords and the required number of dry batteries for transmission and the night alarm bell.

Above the cord terminal board are mounted the line equipments. Immediately above the space for the line equipments is a partition which serves as a shelf for the induction coil with its terminal block and for the telephone gravity switch-hook.

In the upper end of the cabinet is mounted a powerful generator for heavy toll line ringing. Immediately back of the generator is mounted a polarized buzzer in the generator circuit.

The line equipment wiring is made up in a cable form complete for the ultimate capacity of the board, regardless of the number of drops originally installed. The wires are provided with a special clip so that drops may be readily installed at any time. The cable form is led to a terminal strip, which is mounted on the inside of the special back-board. The line equipments of this board are of the "International" combined jack and self-restoring drop type.

This drop is so designed that it does not depend on restoring the shutter by the plug coming in direct contact with the shutter when inserted. To avoid these parts readily becoming out of adjustment and to give a new and absolutely non-infringing automatic restoring device, the drop is supplied with a small trigger (See Fig. 2), which is mounted between the springs of the jack on a strong German silver compensating spring. This trigger is so actuated by the plug, when inserted, that the shutter is automatically restored.

The line equipments are mounted in strips of five and are supplied for either toll line or for local exchange work. Each pair of cords is supplied with a clearing-out drop and a combination ringing and listening key with ring-back key. The "International" key is simple in design and very durable and reliable in its construction. It is so built that it requires but one set of main generator spring for both the ringing and listening key and ring-back key. All the springs are firmly clamped to a heavy brass block by binding screws passing through them in insulating bushings and threaded into heavy brass nuts. The spring blocks, with all springs, are self-contained, and are supported by a steel bracket mounted on the bottom of the lever escutcheon plate. The

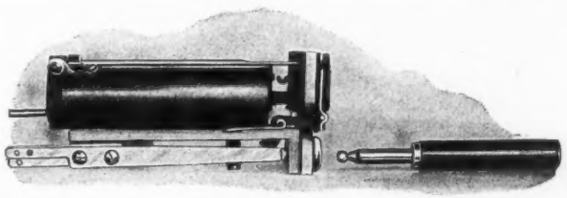


FIG. 2.

key springs are of the best German silver and are long, to give them lasting quality. They are provided with platinum contacts securely riveted. The keys are so constructed that they may readily be mounted on any style switchboard.

The "International" jack and drop is so designed that it may be fitted for any make or style switchboard, by simply making the jack ferrule of the proper size and length to correspond with the style or make of plug with which they are to be used. For this purpose, the equipments are mounted on strips of five or ten of such special size as will conform with the board for which they are intended.

Patents have been allowed the International Company, fully protecting their self-restoring drop apparatus, making it one of the safest and most reliable equipments of its kind on the market.

THE ADJUSTAPHONE.

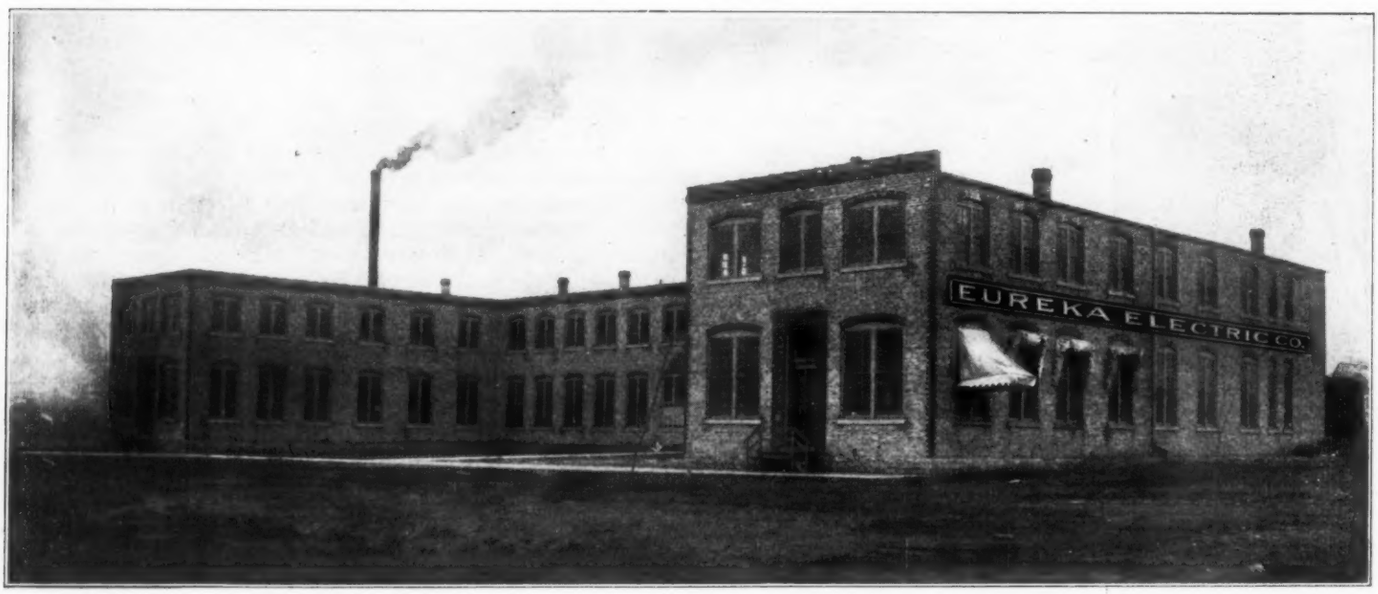
Among the latest automatic exchanges to adopt the toggle arm principle in connection with the desk set is the Citizens' Telephone Company of Grand Rapids, Mich. These arms practically make the automatic desk set as economical as the Adjustaphone. The Chicago Writing Machine Company, 87 Wendell Street, which manufactures the Adjustaphone, and which furnishes the toggle arms for the automatic desk sets, reports a steadily increasing volume of business. Inquiries are being received from many of the new exchanges throughout the country, and from newly incorporated companies which are endeavoring to put in, at the start, the most efficient and economical apparatus obtainable.

The Chicago Writing Machine Company claims that the Adjustaphone will save its own cost inside of a year by materially decreasing the cost of maintenance of the desk set. As the Adjustaphones are a great convenience to subscribers, many managers of Independent companies find that their subscribers are willing to pay a higher rental for the Adjustaphone, and the companies are therefore perfectly willing to put them in in place of the old style desk sets. By purchasing Adjustaphones without transmitter and receiver, the transmitter and receiver in use on the old desk stands can be utilized.

The manufacturers will be glad to furnish descriptive matter at any time, on request.

Eureka Electric Company

The Eureka Electric Company of Chicago and Genoa, Illinois, one of the best known manufacturing companies in the Independent telephone field, was organized in October, 1898, and from the date of its organization to the present time the company has been a marked factor in the development of the Independent telephone industry. The company is an Illinois corporation, and up to last summer had its factory and general offices located in Chicago. Its continually growing business necessitated its moving several times in the city to secure sufficient floor space, and in July, 1903, the company erected its own factory building at Genoa, Illinois, and moved to that town, where the company has the benefit of Chicago freight rates to all points, and has splendid railroad facilities. The Chicago, Milwaukee & St. Paul, Illinois Central and Northwestern railroads all enter Genoa, giving the company a direct outlet for shipments to all sections of the country.



EUREKA ELECTRIC COMPANY FACTORY, GENOA, ILLINOIS.

That the move to Genoa was a good one is evidenced by the fact that the company was never so busy, nor in so prosperous a condition as at the present time, the April business being the largest in the company's history, and while the factory is being operated overtime there is over one hundred thousand dollars' worth of unfilled orders on hand.

A view of the Eureka factory is shown on this page, and gives an idea of the growth of the company from a small factory on Canal street, Chicago, in 1898, to the present modern building, which covers a great deal of ground and contains nearly forty thousand square feet of floor space. The factory is light on all sides and is equipped with the latest and most modern machinery throughout. A number of views are shown to give the reader an idea of the interior of the Eureka plant, where upwards of two hundred and fifty hands are employed and which has an annual output which runs up to hundreds of thousands of dollars.

It might be well to mention something of the men who have been identified with the success of the Eureka company. I. J. Kusel, the company's president, is one of the pioneers in the Independent telephone field. He is a product of Illinois, having been born in Chicago in 1865. He entered the general electrical business in St. Louis in 1888 and continued in that line of business until 1893, when he entered the Independent telephone manufacturing field. He was president and owned the controlling interest in the Missouri Telephone Construction Company, one of the earliest concerns devoted to the manufacture of apparatus for the Independent telephone exchanges. From 1893 to the present time Mr. Kusel has been prominently identified with the telephone manufacturing business and is well known throughout telephone circles. He is aggressive and forceful and has done much to make the Eureka company what it is.

Howard W. Foote, the general manager of the company, was born in Cambridge, Maryland, Aug. 31, 1857. After completing his education he engaged in the dry goods business in New York City. After three years in this line he became associated with the old house of J. Howard Foote, manufacturers and importers of musical merchandise. He commenced with this house as order clerk and worked through all departments to the position of general manager. When Mr. Foote came to Chicago he associated himself with a syndicate which controlled the Newyago Portland Cement Company, Newyago, Mich.; also the National Portland Cement Company of Easton, Pennsylvania. These two companies had a combined capitalization of $5,500,000.

Mr. Foote is a close student of business conditions and has had a practical business training. He understands the manufacturing business and has been a potent factor in building up the Eureka business. While only connected with the company for some five months, he has increased its sales over seventy-five per cent, and under his management the entire Eureka factory has been systematized and modern methods of manufacturing have been introduced. He is a

man of strong personality and sterling qualities. His aggressive management is making itself felt, and it is safe to assume he will make the Eureka company better known and stronger in every way.

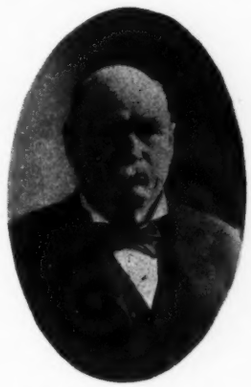
H. V. Messenger, secretary and treasurer of the company,

I. J. KUSEL.

is an able financier, being connected with a number of successful enterprises. He is interested in the banking business, and is well known in commercial circles.

H. J. Kusel, vice-president of the company, is one of the

HARRY J. KUSEL.



H. V. MESSENGER.

most popular men in the field. He has been in the business for over seven years, spending most of his time traveling in the interests of the company.

The apparatus manufactured by the Eureka company is too well known to call for extended mention. It is in use in many exchanges throughout the United States, and has met with the approval of exchange managers. The company manufactures a complete line of telephone exchange equipment and accessories.

That these goods are of a high class and are giving satisfaction is shown by the ever increasing demand for the apparatus manufactured by this concern. It can truly be said that it is keeping pace in every way with the rapid growth of the Independent movement and that is is fully

HERBERT ROSENOW.

ROBERT MITTEN.

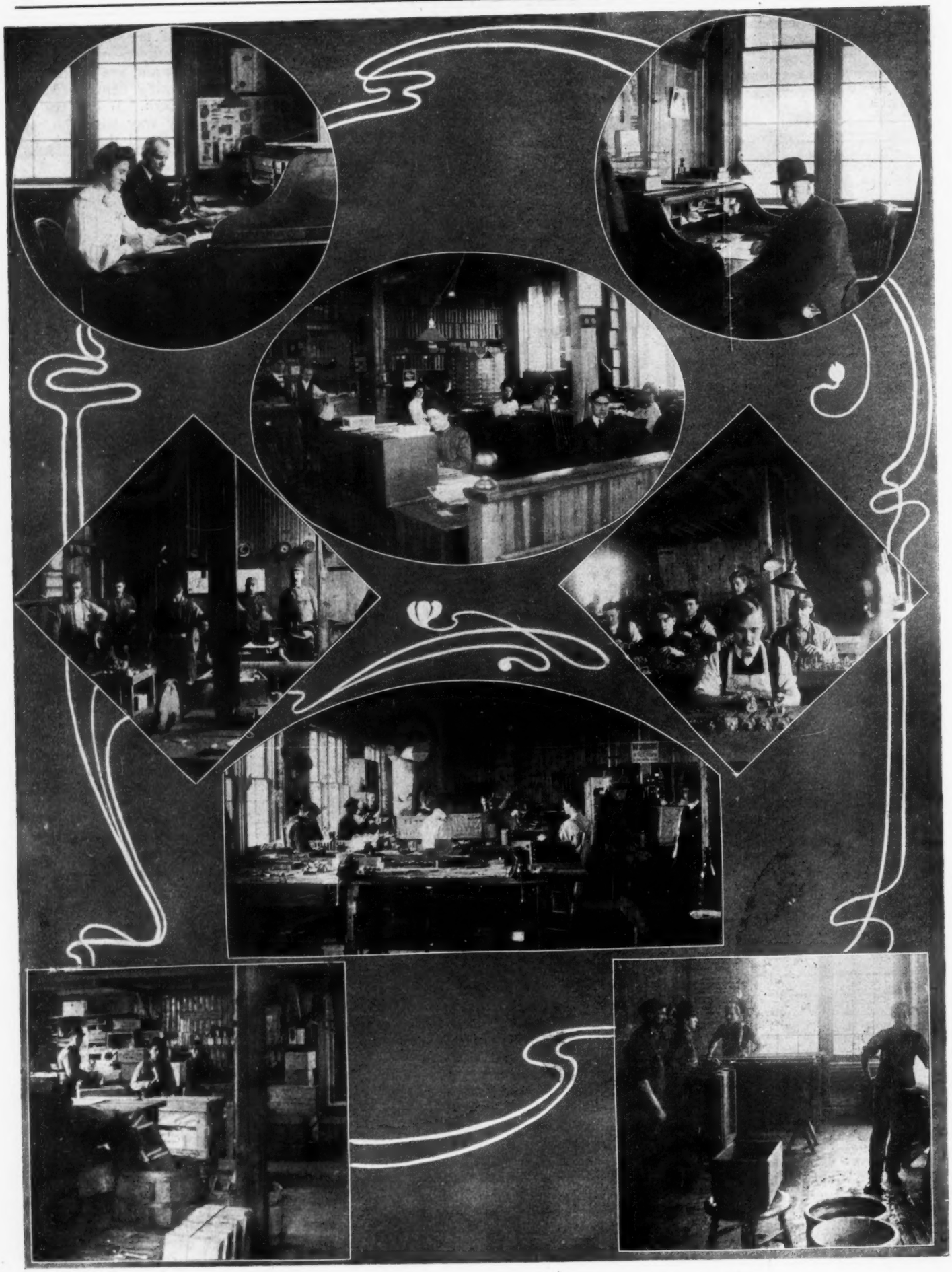
alive to the needs of Independent buyers, sparing neither time, effort nor expense to attain absolute perfection in the matter of quality in goods and improvements.

It is this mode of doing business that has brought to the

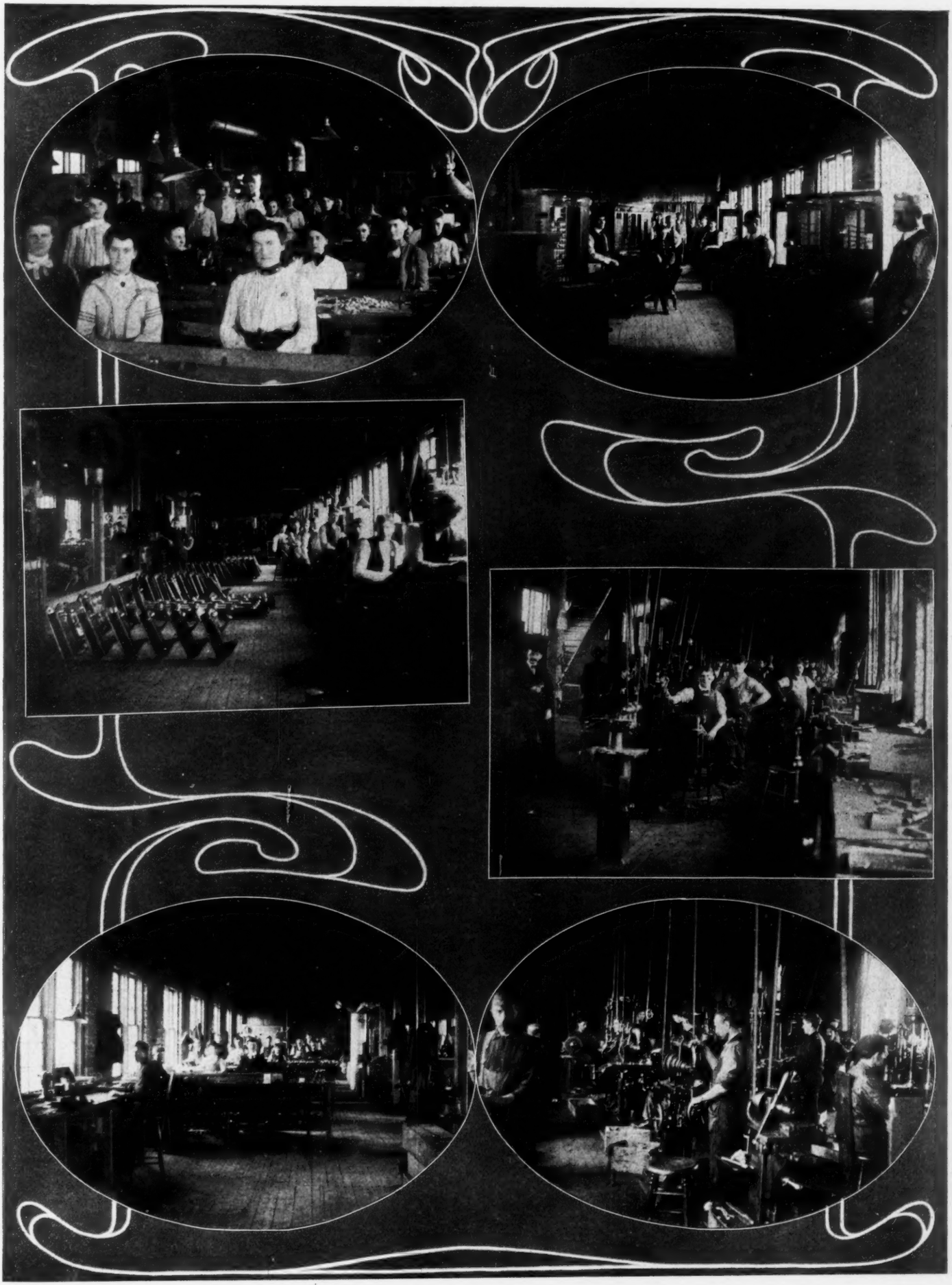
HOWARD W. FOOTE.

Eureka Company such a large measure of success and presages for it still greater things in the future.

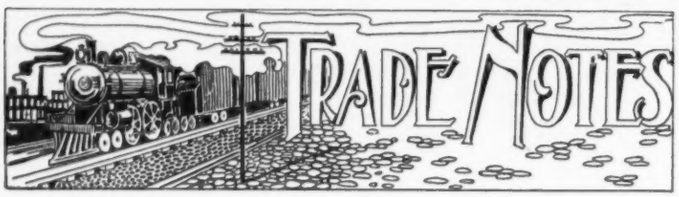
The people of Genoa point with pride to this successful manufacturing industry and attribute the prosperity of the town, in a large measure, to the Eureka Company, which causes to be distributed locally each week, through its payroll, a large sum of money.



VIEWS IN THE EUREKA ELECTRIC COMPANY'S FACTORY, GENOA, ILLINOIS.



VIEWS IN THE EUREKA ELECTRIC COMPANY'S FACTORY, GENOA, ILLINOIS.



THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, has recently brought out an interesting little catalogue treating on Leich four-party selective telephones. This catalogue will be sent on request.

THE H. S. COUCH COMPANY, 156 Pearl street, Boston, Mass., has just brought out its illustrated price list "B," which shows many combinations in which its telephones can be used. This price list will be sent on request.

THE SWEDISH-AMERICAN TELEPHONE COMPANY is mailing to its customers a 32-page "Toast Book" chock full of bright, live, clever toasts. This book is in keeping with other high-class publications issued by this enterprising concern.

THE MCROY CLAY WORKS, Brazil, Ind., and Chicago, dropped into poetry in its April calendar blotter. "Regrets" doesn't exactly bear upon the merits of "McRoy conduits," but it is a breezy bit of verse and well worth reading just the same.

THE EUREKA ELECTRIC COMPANY, Genoa Illinois, has opened a general sales office at Suite 617-618 Monadnock Block, Chicago, where a complete line of Eureka apparatus will be on exhibit. The office will be in charge of Messrs. I. J. and H. J. Kusel.

JAMES S. BARRON & COMPANY, West Broadway and Franklin street, New York city, will send, upon request, samples of fibre cleats for telephone work. These are made in three colors. The company reports that it is meeting with a large demand for this material.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., manufacturer of many special designs of insulators for all kinds of electrical work, will increase the capacity of its plant from 50 to 100 per cent, to meet the growing demand for its products.

THE INTER-OCEAN TELEPHONE & TELEGRAPH COMPANY, Buffalo, N. Y., reports an increase in long distance business. The lines of the company are being rapidly extended in western New York state. It is now connected with at least 500 towns and over 50,000 subscribers.

RABER & WATSON, Chicago, have issued another neat card folder to the trade, advertising "long" cedar poles, presenting a half-tone picture of "Long Tom" Brockman, the colored giant, by way of impressing on the reader the fact that their goods have the requisite height.

THE F. BISSELL COMPANY, Toledo, Ohio, is sending out an attractive little booklet entitled, "A Comfortable Upper Berth in a Pullman Car." It describes the full line of "Security" specialties manufactured by the Bissell Company, and is especially intended for the telephone trade.

THE THOMAS E. CLARK WIRELESS TELEGRAPH-TELEPHONE COMPANY, Detroit, Mich., will be pleased to send its bulletin No. 10, giving facts about wireless telegraphy. This bulletin describes the instruments for wireless telegraphing and shows a number of typical installations. There is also a treatise on space telegraphy by Thomas E. Clark. The factories, laboratories and test stations are at Pontiac, Mich.

THE HARVARD ELECTRIC COMPANY will move on May 1 into new quarters at 60-66 West Van Buren street, Chicago, where it will have four times as much floor space as heretofore. The increase in the demand for Harvard Protectors made necessary a larger plant for their manufacture.

QUEEN & COMPANY, Inc., Philadelphia, have issued a handsome and instructive circular in honor of the fifty years of their existence, 1853-1903. It gives a synopsis of the history of the house, illustrates some of its leading apparatus, and gives views also of its laboratories, factories, etc.

THE ILLINOIS ELECTRIC COMPANY, Chicago, is sending out a revised net price list and discount sheet, applying to catalogue No. 15. It relates to high-grade telephone construction material and specialties. It also carries an insert touching on the merits of Washington fir cross-arms.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, has just issued a 32-page pamphlet, in which are printed copies of many letters received from patrons of the Home Telephone Company of Dayton, Ohio, testifying to the satisfactory service rendered by the automatic exchange in that city.

THE EUREKA ELECTRIC COMPANY, Chicago and Genoa, Ill., is now running its factory overtime and reports a most successful spring outlook for business. The company will be pleased to send its latest 1904 bulletin and printed matter describing its well-known line of apparatus to any company desiring same.

THE NATIONAL INDIA-RUBBER COMPANY has removed its offices to the twelfth floor of 42 Broadway, New York city. The company will be represented as follows: Rubber-insulated wires and cables, Henry D. Stanley; hose, belting and packing, Albert B. Pratt; druggists' sundries, Henry D. Archer.

FRANK B. COOK, Chicago, announces that he has secured license to manufacture the protective devices belonging to the Rolfe Electric Company, including all forms of self-soldering heat coils. This gives Mr. Cook a very complete line of telephone protective apparatus and accessories. Correspondence is invited.

THE CROWE METAL MANUFACTURING COMPANY, Chicago, illustrates a number of types of its stampings in a new catalogue which it has just issued. This company is the manufacturer of the Crowe patented labor-saving machinery for the production of ornamental and indestructible metal advertising cards.

THE TELEPHONE PRINTING COMPANY, Defiance, Ohio, has issued a brief circular which describes a novel enterprise, namely, the design and publication of blanks for the purpose of transacting telephone business of all descriptions. Forms are printed and supplied for all departments of telephone and toll accounting.

THE SUMTER TELEPHONE MAUNFACTURING COMPANY, Sumter, S. C., reports that it is enjoying a season of unexampled prosperity—the greatest in its history. The business of the company for the past year has been far beyond the capacity of the plant to turn out, and in spite of the fact that the factory is being run day and night, it has been found impossible to catch up with the orders. New machinery is being added, which, when fully installed, will double the capacity of the plant. The company manufactures telephones, switchboards, magneto bells and telephone

appliances, and the demand for their apparatus is very heavy.

THE INDIANA RUBBER AND INSULATED WIRE COMPANY, Marion, Indiana, has just finished shipments to four foreign countries and has other orders to be sent abroad. The first of the recent orders was for 200,000 feet of telephone cable, which was shipped to Yokohama, Japan; the second for one ton of rubber tape to Paris, France.

THE CENTRAL ELECTRIC COMPANY, Chicago, has issued a new price list, dated April, 1904. which applies to the company's latest catalogue, and in which are quoted the latest discounts and prices prevailing on all electric material. The list is attractively gotten up, and the company requests that all purchasers of material who have not received a copy will write for one.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, Buffalo, N. Y., has recently closed a contract with the Warner Telephone Company of Gowanda, N. Y., for the entire building of its new plant. The contract includes the outside plant construction, central station equipment and sub-station instruments; it also calls for a complete common battery system of the latest design.

THE ELECTRIC GAS LIGHTING COMPANY, 195 Devonshire street, Boston, Mass., is distributing a new catalogue descriptive of Edison primary batteries. These batteries are for telephone systems and all classes of work where a primary battery may be used. The catalogue illustrates the many types in which this cell is made, and also gives directions for making the jar liquid type and for charging.

ROSSITER, MACGOVERN & COMPANY, Whitehall building, 17 Battery place, New York City, has removed its St. Louis office from the Missouri Trust building to its factory at Papin street and Compton avenue, St. Louis. On account of the large amount of business the company was doing in that city this move was necessary, as there are greater facilities for handling material direct from the factory and warehouse.

THE WESTON ELECTRICAL INSTRUMENT COMPANY has opened an office at 426 Williamson building, Cleveland, Ohio, in charge of G. L. Crosby. Mr. Crosby will handle the "G-I" company's circuit-breakers and will cover a territory comprising western Pennsylvania, Ohio and Michigan. Mr. Crosby has covered this terrtory before in a similar capacity and is familiar with the business of that territory in this line.

JAMES S. BARRON & COMPANY, New York, dealers in general electrical supplies, were burned out on April 8, suffering a loss by fire upon building and contents of $185,000, fully covered by insurance. This enterprising firm immediately opened up headquarters at 339-343 Greenwich street, where it will conduct its business until the completion of its handsome new building on the old site, which will be about May 1, 1905.

THE STERLING ELECTRIC COMPANY, Lafayette, Ind., manufacturers of switchboards, common battery multiple, lamp signal magneto and standard Bell type, reports an unusual activity in switchboard work, having contracted for switchboards and additional equipment during the past month for exchanges in Cairo, Clinton, Decatur, Hoopeston, Canton, Tremont, Kansas and Newton, Illinois; Peru, Auburn, Russiaville, Goldsmith, Zionsville, Seymour, Avery and Straughn, Indiana; Racine and Sheboygan, Wisconsin; Hudson and Albany, New York; McArthur and Austinburg, Ohio; Sully and Webster City, Iowa; Abilene, Texas; Chardon, Nebraska; Brockville, Pennsylvania; Stockbridge, Michigan.

THE F. BISSELL COMPANY, Toledo, Ohio, has sent out its bulletins Nos. 27, 28 and 37. Bulletin No. 27 treats on field regulators, theater dimmers, theater switches and electric bunch lights. No. 28 shows and describes circuit-breakers and oil switches, and in No. 37 is illustrated and described electrical house goods, such as annunciators, call systems, telephone systems, push-buttons, bells, buzzers, etc. Bulletins will be sent on request.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, announces that the Citizens' Telephone Company, Columbus, Ohio, has increased its order placed with the company some time ago, calling for a complete automatic equipment for 7,000 stations initial installation. The new order makes the number 8,000. The Citizens' Company will erect a new building for the automatic exchange, which will be designed especially for this type of equipment.

THE CONTROLLER COMPANY OF AMERICA, Chicago and St. Louis, is installing an all-cable telephone plant of between 200 and 300 telephones on the World's Fair grounds at St. Louis, using measured service telephones of its own manufacture. The plant represents the highest type of modern telephony. LeRoy W. Stanton, Cleveland, Ohio, is supervising the installation of the plant. Mr. Stanton has recently opened a branch office in the Monadnock building, Chicago.

THE CALCULAGRAPH COMPANY, New York, has issued an attractive circular, entitled, "Before and After," the title referring to the use of the Calculagraph for timing telephone toll messages. It briefly tells a story as to what was done by the old method of figuring and comparing time tickets and the great saving that has been effected since the Calculagraph took all of this mechanical work from the operator. The pamphlet is a telling argument in favor of the use of the Calculagraph.

THE HAZARD MANUFACTURING COMPANY, Wilkesbarre, Pennsylvania, gives very complete information—much of it in tabular form—of its extensive line of products, in a neatly gotten up pamphlet of recent issue. This company manufactures electric wires and other equipment for telephone systems. All copper wires used in the manufacture of its insulated wires and cables are drawn in the company's own wire mill. The pamphlet is copiously illustrated, showing sections of cables of many varieties and for all purposes, and is replete with tables. It will be mailed upon request.

THE COUCH & SEELEY COMPANY, Boston and New York, has issued a handsome new catalogue descriptive of its telephone switchboards and telephone accessories. This company's apparatus is in use in over 3,000 Independent exchanges, private plants, government buildings, railroad plants and industrial establishments. The catalogue gives an accurate description and prices of the company's apparatus, and the half-tones show very clearly the appearance of the devices. An interesting supplement to the commercial details of the catalogue is a series of plans showing the manner in which circuit connections are made.

THE LAMBERT SCHMIDT TELEPHONE MANUFACTURING COMPANY, Weehawken, N. J., has issued a new catalogue (No. 11) descriptive of its automatic-reset inter-communicating telephones and telephonic devices. It is illustrated with handsome half-tone cuts showing the various styles of instruments manufactured, all of which are for interior use. This company makes a speciality of private telephone systems for residences, offices, factories, yachts, hospitals, ho-

tels, etc., and has installed plants in many of the Government department buildings, besides scores of big mercantile and manufacturing establishments throughout the country. The catalogue will be sent upon request.

THE FIBRE CONDUIT COMPANY, Orangeburg, N. Y., has opened offices in the Monadnock building, Chicago. W. W. Smythe, Jr., formerly connected with the American Stone Conduit Company, has assumed the western management of the company, and is making a strong campaign for business throughout the central and western states. Fibre conduit is manufactured of wood pulp, which is rolled into shape under heavy pressure, after which it is thoroughly impregnated with a highly insulating water-proof compound. It is claimed for Fibre conduit that for underground construction it cannot be surpassed as regards ease of handling, speed in laying and lack of breakage.

THE INDIA-RUBBER AND GUTTA-PERCHA INSULATING COMPANY, Yonkers, N. Y., has prepared a unique illustrated catalogue concerning its manufacture of Habirshaw wires and cables, compiled by Frederick J. Hall. The text is comprehensive and accurate, and instead of depending upon half-tone reproductions for illustration, photographic prints have been mounted throughout the book, showing in detail the section of various types of the Habirshaw cables. This is one of the most interesting publications which has ever been produced by a manufacturing company, and will do a great deal in bringing to the contractor a perfect knowledge of the mechanical and electrical features of this material.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, has issued a neat booklet treating on the subject of selective telephones for central energy systems, as manufactured at its plant, which gives the theory of operation and practical hints on the installation of the American system, made clear by the aid of numerous good diagrams. Among the advantages held up by the company in favor of its system are the absence of any relays in the equipment; the fact that in signaling the high-frequency bells on two-party line selective circuits no ground is used, only one master key being necessary; the absence of compensating springs in bell equipment, and the fact that the condensers are connected in series with the equipment, preventing loss of current.

THE SWEDISH-AMERICAN TELEPHONE COMPANY, Chicago, has recently closed contracts with the following named telephone organizations for their complete equipment, ranging in capacity from 100 to 500: Guide Rock Telephone Co., Guide Rock, Neb.; Farmers' Mut. Co., Columbia City, Ind.; Denver Co-operative Co., Denver, Ind.; Farmers' Co., Union Hill, Ill.; Boynton Co., Berlin, Ill.; Maurice Co., Maurice, Ia.; Liberty Center Co., Liberty Center, Ind.; W D. Hunt Co., Oak Grove, Mo.; Mexico Home Co., Mexico, Ind.; Holstein Co., Holstein, Neb.; Conway Rural Co., Conway, Kan.; Pekin Co., Pekin, Kan.; Farmers' Co., Galena, Kan.; Burkey-Calhoun Co., Ashland, O.; Norwalk Co., Norwalk, Ia.; Farmers' Co., Amity, Ore.; Allyn Yocum Co., Sheridan, Ore.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburg, announces the recent opening of a branch office or headquarters in the Security building, St. Louis. This office is in charge of W. A. Caldwell, who was formerly connected with the Chicago office of the company, but more recently with the home office at Pittsburg. Mr. Caldwell has had a number of years' experience with the company in both the construction and sales departments. This company has now seven district or branch offices throughout the country, as follows: The northeastern sales department, Delta building, Boston, Mass.; the eastern sales department, 56 Liberty street, New York city; the southeastern sales department, Betts building, Philadelphia, Pa.; the central sales department, Westinghouse building, Pittsburg, Pa.; the western sales department, the Rookery building, Chicago, Ill.; the southwest sales department, Security building, St. Louis, Mo.; Pacific coast sales department, Crossley building, San Francisco, Cal.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., and Chicago, has just issued an exceedingly attractive and artistic reminder in the shape of a calendar. On the upper right-hand corner an American Beauty rose appears. On the other side is mounted a genuine matt surfaced photographic print of a beautiful young woman in the act of using a telephone. To attempt a description of an American Beauty rose would be superfluous, and the authors of the calendar have certainly succeeded in selecting from their garden of girls a flower which far outrivals even the queen of the rose tree. In the lower left-hand corner, a small calendar appears. The Stromberg-Carlson Company will forward one copy of this artistic production to the heads of operating companies on receipt of five two-cent stamps, to cover cost of mailing.

THE STANDARD TELEPHONE AND ELECTRIC COMPANY, manufacturers of telephone and switchboards, has moved its offices and factory from Madison, Wisconsin, to Milwaukee, where it has commodious quarters in one of the finest buildings in the Cream City. This change was made necessary, owing to the rapidly growing business of the concern, as in the old location, owing to lack of room, it was impossible to keep up with orders. In the past year the business of this company has shown a remarkable increase, the spring showing more than keeping up the ratio of growth. A shipment of a complete equipment recently was made to Cie National de Telefonos, Guayaquil, Ecuador, South America. Other similar outfits have recently been shipped to Guatemala and Chihuahua. A picture of the new home of the Standard Company appears on another page.

THE STANDARD VITRIFIED CONDUIT COMPANY, 39-41 Cortlandt street, New York city, has completed its plant at South River, N. J., and its perfect equipment. Owing to the great demand for conduit manufactured by this company, its plant has run continuously since it started in 1902. In this time an enviable reputation has been gained by it on account of its promptness in delivery of a strictly high grade material. Under patents of R. W. Lyle, the company is manufacturing multiple duct conduit. It also furnishes free to its customers its own patented mandrel for laying single duct, which yields great economy in construction. Ample stock of both standard and special sizes, together with fittings, are kept on hand for short notice delivery. Forty million feet of conduit annually can be produced by its factories. Its illustrated catalogue—a work of art—will be sent on application.

TRIPLE EXPANSION LOOSE LEAF BINDERS.

We call the attention of our readers to the advertisement in this and former issues of Plew & Motter, Marquette building, Chicago. They are the manufacturers of the Triple Expansion Loose Leaf Binders for ledgers, records and all loose leaf systems. It is claimed for their binder that it has the greatest expansion of any similar device on the market, being, as the name implies, "triple-expansion." They also claim that it is the lightest, handsomest, strongest, most durable and altogether the best binder made.

The loose leaf system is being generally adopted in every line and the demand for a really good binder is great. In addition to the above they manufacture a good transfer binder, for binding the filled and completed sheets. This

locks with the same key as the current binder and the two are made uniform in size and appearance.

They also furnish any style of ruling and printing and carry on hand at all times a very complete stock of ruled paper for their various stock sizes. One of their specialties is an accounting system for telephone companies. This is in the nature of the "Safeguard System." The headings are printed for each month and each account is balanced monthly, and all new entries, together with the previous month's balance, are entered under the current month. These are furnished also for every line of business.

A postal card written to them as above will bring sample sheets, price lists, etc.

NEW RAILWAY TELEPHONE.

A new line of telephone apparatus, especially adapted to meet conditions existing on street railway lines and inter-urban roads, has been designed by the Mayer & Englund Company. The accompanying illustrations show two of the principal types of these telephones. Fig. 1 shows an iron box telephone which is designed for attachment to either iron or wooden poles. The outer case is made of malleable iron and the door equipped with a Yale lock. The whole apparatus is made weatherproof.

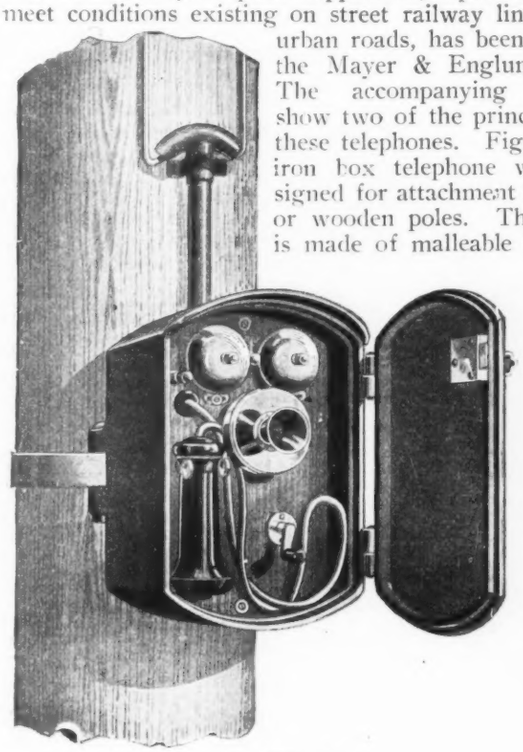


FIG. 1.

All of the working parts of this telephone, including batteries for the local circuits, are attached to one backboard, which is held in place in the iron box by two screws. This, of course, facilitates the work of inspection and repairs, as by the removal of the two screws the entire mechanism can be taken out, leaving the empty iron case on the pole. The inside parts of the telephone are interchangeable, and the entire system can easily be kept in good condition by having one or more extra sets of parts on hand mounted on the board.

Fig. 2 shows a portable car telephone. The interior equipment and the arrangement of this telephone, all of which are mounted on one board, as well as the operating parts themselves, are identical with those of the pole telephone, the only difference being that this outfit is installed in an oak box, with a leather carrying strap. Ten to twenty feet of cord are supplied with this instrument, and at the end of the cord there is attached a plug which is made to be inserted in a specially designed jack box shown in Fig. 3.

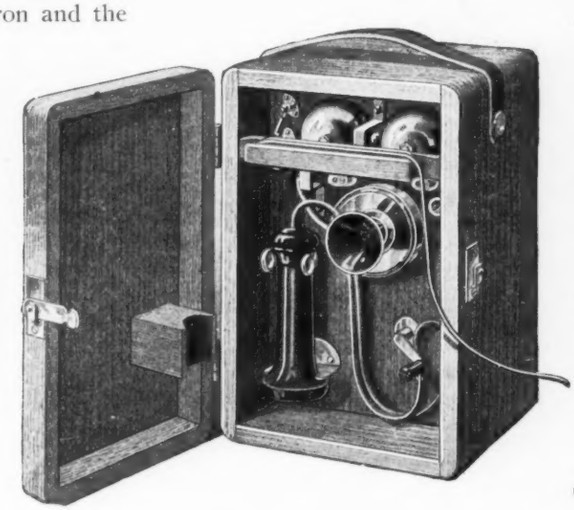


FIG. 2.

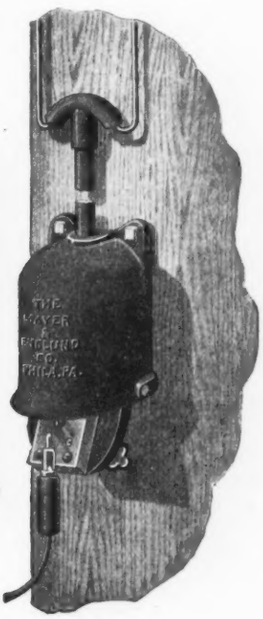


FIG. 3.

These jack boxes are made of malleable iron and are weatherproof, and under all ordinary conditions are also tamper-proof. The jack box may be installed on poles along the side of the road, one to each half mile or so, and communication had with the central office by plugging in at these points. The length of the cord will allow the motorman to leave the instrument in the vestibule of the car, so that it need not be exposed in stormy weather, the vestibule forming a telephone booth.

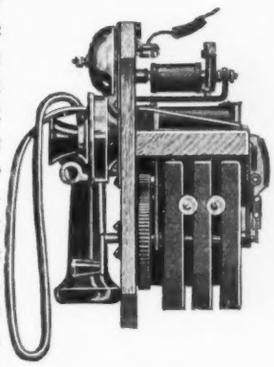
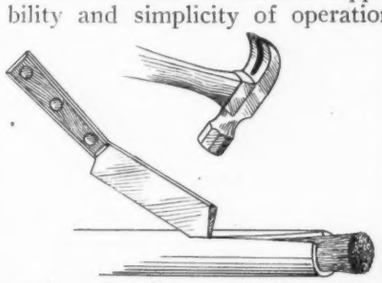


FIG. 4.

Fig. 4 shows the details of the mechanism, which is mounted on the board. The instruments are made with standard long-distance transmitter, bipolar receivers and full-sized hooks with ample contact surfaces. While the instruments are very compact, they do not contain any miniature parts, everything being of the full standard size and therefore conveniently and quickly renewed. The generators are generally wound for 40,000 ohms, and the ringers for 1,600 ohms.

CABLE SHEATH CUTTING KNIFE.

The cable sheath cutting knife shown in the accompanying illustration is a brand new thing on the market and fills a want not heretofore supplied. Its general practicability and simplicity of operation will appeal strongly to telephone men and all those who have to do with the laying of cables, in which the cutting of the sheath is so often an important item. This simple little instrument does the trick quickly and neatly. The cut shows how the knife is to be used and tells practically the whole story. It was designed by the F. Bissell Company, wholesale electrical supplies and machinery, 226-230 Huron Street, Toledo, Ohio, which is now ready to place the knife on the market.

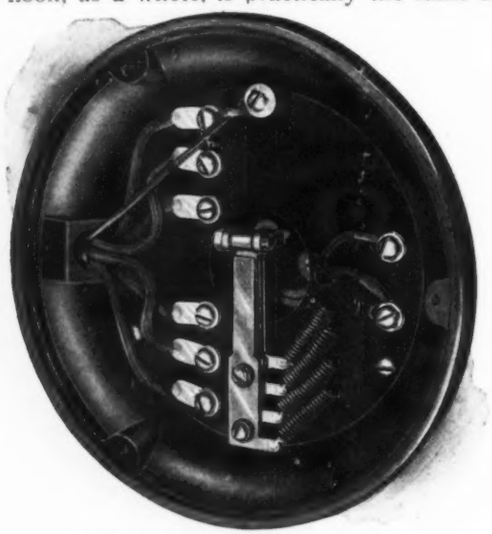


TELEPHONE DESK STAND.

The Monarch Telephone Manufacturing Company, Chicago, recently started the manufacture of a new desk stand, which has already gained the commendation of the telephone trade. It will be seen from the accompanying illustration that this stand is simple in design, and yet the contrast between the nickel-plated parts and the jet black tube and receiver makes it attractive and even elegant in appearance.

MONARCH TELEPHONE DESK STAND.

As in all other "Monarch" apparatus, the construction of this desk stand is such as to place all the parts in a position to be readily inspected. The hook switch is mounted in the base on a thick insulating block, which is securely fastened to the cast iron bottom. The arrangement of the springs and the hook, as a whole, is practically the same as in the



DESK STAND BASE UNCOVERED.

wall sets manufactured by this company. The operation of the switch is absolutely positive. A rod extends from the hook down through the tube, and on the end is fastened, by means of a saddle, to the line spring of the switch. A long phosphor bronze spiral spring fastened within the tube gives the hook a quick, strong action. The springs of the switch are made of phosphor bronze, and are equipped with pure platinum contact points. The cord terminals are conveniently mounted on the insulating block in the base, where they may be gotten at by removing the felt covered sheet iron bottom.

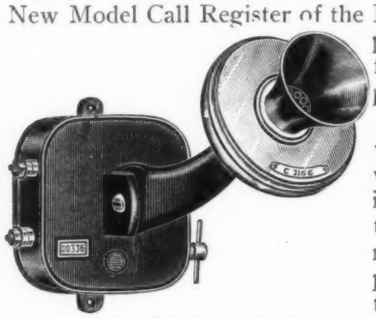
No transmitter connections are made through the frame of the desk stand, as a two conductor cord is carried from the binding posts within the shell of the transmitter down through the tubes and connected on to the insulating block.

Everything possible has been done to make the set simple in appearance and construction, and yet of such strength as to withstand the hard usage given to this type of telephone. Orders received to date go to show that a long felt want has been satisfied by this new "Monarch" desk set.

For further particulars as well as prices, write the Monarch Telephone Manufacturing Company, 14-16 South Clinton street, Chicago.

IMPROVEMENT IN CALL REGISTERS.

The illustration herewith shown represents the No. 81 New Model Call Register of the Baird Manufacturing Company, Chicago, which is fully described in the company's new catalogue.



BAIRD CALL REGISTER.

This register is fitted with a duplex signal, which it is impossible to imitate, and by reason of the visible seal, the mechanism is absolutely protected against being tampered with by unauthorized persons.

The new catalogue of the Baird Manufacturing Company describes and illustrates a great variety of entirely new and improved apparatus indispensable to profitable telephone service. It will be sent upon request. Offices, 24 Michigan street, Chicago.

MOON FUSE TERMINAL HEAD.

The Moon Manufacturing Company, Chicago, is sending out to the Independent telephone exchanges throughout the country a circular describing in detail the Moon terminal head, which it manufactures, and presenting a comparison of the cost of installing and maintaining its apparatus as against a pot head and the necessary protective apparatus usually installed with it. The following excerpts from its circular state the proposition in brief:

The moon fuse terminal, set in its metal outer case or pole box, is complete in itself. It is ready to fasten on the pole and run in the cable. No pot head is used, and no splicing of wires is necessary, as the cable wires extend direct to the terminal connections on the inside of the terminal head. All wires are tested before sealing the head. The self-soldering nozzle is heated with a blow torch and the work is complete.

A man of ordinary knowledge of electrical apparatus can do the work competently and in the shortest space of time, and this feature should be recognized as a great advantage in hurrying forward the construction work.

Many Moon terminals go to outlying districts where men particularly skilled in telephone apparatus are not available. These terminals are properly installed without difficulty. We are warranted, therefore, in saying that no skilled or high-priced labor is necessary to properly install a Moon fuse terminal head.

The Pot Head Apparatus has a record for losses which should condemn its use. No one ever claimed anything more for it than that it was cheap. We have endeavored to call to your attention the fact that it is not cheap to install, and this feature has evidently been overlooked by the engineer and the contractor, as well as the managers of many exchanges.

The Moon Manufacturing Company, 43-49 Canal street Chicago, invites correspondence and will be glad to mail its catalogue and price list upon request.

The Telephone in Foreign Countries

THE TELEPHONE IN BUENOS AYRES.

There has been some friction between the municipal authorities of Buenos Ayres and the telephone company on the subject of the placing underground of the telephone wires. Says the Buenos Ayres *Standard*:

The placing of telephone wires underground, desirable from every point of view, should be everywhere encouraged to the utmost extent, and especially in cities like Buenos Ayres, where overhead trolley wires extend in every direction. As these trolley wires have been permitted, the ordinance requiring their effectual protection should be thoroughly carried out by insisting upon the latest and most efficient methods of protection instead of the antiquated and very inefficient provision which has been allowed. Encouragement should also be given to the telephone companies to put their wires underground. The expense involved is, of course, great, and this should be taken into consideration. The practice, however, in Buenos Ayres at present is to discourage such work by special imposts, such as the charge of $100 per square [yard] for opening the streets, and sundry other charges, in the aggregate reaching considerable sums if work is done on an extensive scale. It follows that without inducement telephone companies are likely to postpone laying down extensive systems of underground plant, and to omit them altogether when possible, if they find that instead of being encouraged they are, as is the case in Buenos Ayres, practically fined for so doing.

The causes for a defective telephone service are many, and increase with the number of subscribers. The trouble may be in the telephone itself, in the battery to which it is connected, in the installation, wires, etc., in the subscriber's house, in the line wire outside connecting with the exchange, in the jointings of this wire, in the insulators, in the innumerable connections, in the lightning arrester and cross-connecting boards, or in that most complicated piece of mechanism known as the switchboard. Then the operators are not perfect in their duties, or the subscribers considerate in their demands; it, therefore, approaches the miraculous that communication is possible at all to any large number of the thousands connected, and it is only through constant watchfulness that the many recurring faults are ascertained and remedied. Duly considered municipal encouragement should consequently be given with regard to such an expensive feature as the placing of wires underground.

In Latin countries the value of time is not greatly appreciated, and concentration of speech is not a characteristic. The result is, as shown by actual observation and test in Buenos Ayres, that communications occupy on an average twice the time they do in New York, and the average is about twice as many communications per day per subscriber. The practical outcome of this is that a switchboard operator in Buenos Ayres takes care of only half the number of subscribers that one in New York does, and is of but one-half the value. The Union Telefonica has expended over £100,000 in the past five years in new switchboards and in appliances and underground plant in Buenos Ayres, and is preparing for a further expenditure of a like amount. It is changing its subscribers' single lines to metallic circuits, enlarging the central exchange and adding to the technical staff. This skilled labor it has been found impossible to obtain in Buenos Ayres to anything like the required extent, and experienced men are being continually engaged and sent in from Europe.

The comparison of the rates in Buenos Ayres with those in force in London, where the service is certainly no better than here, and with those in New York, where the service is probably the best in the world, is certainly in favor of the subscriber in Buenos Ayres. The general rate per annum in each case is as follows: London, £17 ($195 m|n.); New York, $183 gold ($430 m|n); Buenos Ayres, $180 m|n. The Union Telefonica has nearly 9,000 subscribers connected with Buenos Ayres; the National Telephone Company in London about 30,000. In New York there are nearly 120,000, which is an indication that the quality of the service and not the rates charged is the controlling factor.

THE POSTOFFICE AND THE TELEPHONE SYSTEM.

The *London Electrical Review* publishes the following in regard to the development and extension of the postoffice telephone service in London:

In the House of Commons Lord Stanley submitted, in committee, as a preliminary to legislation, a resolution sanctioning the allocation of £3,000,000 for the extension and development of the postoffice telephone service. He reminded the committee (according to the *Times* summary) that £4,300,000 had been voted for this purpose in past years, and he said that this sum was now very nearly exhausted. The money for which he was asking was wanted for the extension of trunk lines and for the provision of exchanges—£1,300,000 would be set aside for trunk lines; £1,500,000 for London exchanges; and £200,000 for provincial exchanges. He gave a short account of the work accomplished by the department, mentioning that the number of conversations carried on through the telephone in one year was 12,895,883. There was sufficient plant in London for the needs of 40,000 subscribers. The actual number of subscribers was 15,299, and it was expected to increase largely. There were in the metropolis 1,094 miles of underground pipes and 110,128 miles of wire. At the end of 1899 there were 1,259 postoffice telephones in the provinces; now there were 5,000. The receipts were increasing rapidly In the Central London exchange in thirteen months they amounted to £61,000. He believed that it would not be long before the telephone service became a paying concern, and so he was not asking the committee to vote money for an unremunerative object.

The department was not contemplating competition with the National Telephone Company in areas which that company supplied. As the committee knew, the department could give notice before the end of this year of its intention to purchase the undertaking of the company, and it was empowered to proceed by arbitration if an agreement could not be arrived at. As an arbitration would be very expensive, he favored the plan of amicable agreement. Negotiations, he informed the committee, were being carried on at the present moment. No agreement would be held to be binding until it had been ratified by Parliament. He thought he should be able to act on the suggestion which had been made, that a select committee should be appointed to consider the agreement. He also stated that he should be ready to help municipalities desiring to have their own telephones. The resolution was agreed to.

Lord Stanley later modified his statement, and said that *pourparlers* were going on in regard to the purchase, but the stage of *negotiation* had not yet been reached.

GOVERNMENT TELEPHONES IN ENGLAND.

Negotiations are on foot for the purchase by the English government of the National Telephone Company. The advent of a postoffice telephone service all over London will bring the metropolis in a line with such countries as Sweden and Switzerland, where a telephone finds a place in nearly every house.

The government hopes to make the telephone not a luxury which only the rich can enjoy, but a useful adjunct to the poorer man's home. To this end it is most probable that a cheaper tariff will be introduced after the absorption of the National Telephone Company and when the postoffice service is in full working order.

The postoffice telephone service has not been a great financial success, owing to the limited number of subscribers consequent upon a lack of funds to carry out orders. The postoffice has about 16,000 subscribers and has many orders on hand, but since September the department has been practically penniless and work has been at a standstill. All this has now been altered by the grant by the House of Commons of $15,000,000, and the authorities hope very shortly to be able to fulfill all obligations to would-be subscribers.

The telephone is rapidly overtaking the telegraph in the estimation of the public. During the last year, while there has been a large decrease in the volume of telegraphic work dealt with, the telephones are doing more and more work, and the increased rapidity and number of postal deliveries, messenger services, and the like are also robbing the service of its former supremacy.

THE TELEPHONE IN NOVA SCOTIA.

It is of interest to note the progress being made in the use of improved telephones in Nova Scotia.

A new line of long distance telephone, with 292 miles of copper wire, has been opened between Halifax and Syd-

ney, the offices being equipped with the standard relay-energy system, including the latest improvements.

The reports of the company show that in the Province of Nova Scotia there is one telephone in use for every 88 inhabitants. In the city of Halifax there is one to every 27 persons, while in other towns the proportion is between 20 and 30.

The report of the general manager of the Nova Scotia Telephone Company shows 790 miles of poles for their long distance lines and 2,246 miles of copper wire. The total mileage of telephone wires in the Province is 7,136, and the total miles of posts is 791.

The number of telephones in the Province is 3,260, of which 1,801 are in the city of Halifax. Last year the company transmitted 14,000,000 messages. The long distance lines unite Truro, Amherst, Bridgewater, New Glasgow and Windsor-Sydney.

The average number of calls per day, per telephone, in Halifax is 11, compared with 7½ under the old system. Halifax answers daily 18,000 calls; the average per telephone is only 10, although some instruments go as high as 150 calls a day.

The rates for conversations of three minutes between Halifax and points in Cape Breton country are each $1.25 in the daytime and 65 cents at night between 6 p. m. and 8 a. m.

W. R. Holloway, United States Consul-General.

Halifax, Nova Scotia, April 16, 1904.

PORTABLE TELEPHONE WINS HIGH PRAISE.

The latest Swedish invention that is being discussed is a portable telephone. The specimens that have been sent abroad have elicited unstinted praise from Austrian, Russian, Greek and Turkish experts, who have tested them and, while large demands and inquiries for the new telephone have come from France, Germany, Italy, Spain, Portugal and the United States, those from Great Britain have been even more noticeable.

Within the cylinder of the telephone is a small, dry cell, the whole apparatus (including both receiver and mouthpiece) being small enough to go in the pocket. With each instrument is a coil of thin copper wire, and it is reckoned that a soldier could easily carry 13,000 feet of this wire with him.

The uses suggested for the portable telephone are innumerable, military considerations being kept specially to the front. Outposts, it is declared, could by its aid keep in constant communication with the main force, and it is pointed out that it would furnish a valuable means of keeping in touch with headquarters for police and fire brigades. For use between railway coaches on a moving train, for engineers at work underground or on great public works, for steamers, for cyclists and in many other fields it would be most desirable.

FRENCH ACTRESS STARTS TELEPHONE WAR.

The telephone war in Paris is causing no end of excitement. The Parisian subscriber is very small fry in the estimation of the telephone girls. But the worm is showing a disposition to turn, and the time seems to be at hand when the "man who pays the freight" can hope for better treatment. Mlle. Sylviac, a well-known French actress, was breakfasting a few days ago with a friend at her own home, when she found it necessary to use her telephone.

She called for three-quarters of an hour before "Central" responded. Mlle. Sylviac rebuked the girl, and the latter gave the actress an insolent reply.

Thereupon she called up the superintendent and reported the "hello girl."

The next day Mlle. Sylviac received notice that she could no longer have the use of the telephone unless she apologized to the telephone girl.

The actress discovered later that the number for which she had asked had not been called up at all. She immediately instructed her lawyer to bring an action against the company to compel it to restore her telephone rights.

TELEPHONE GAINING ON THE TELEGRAPH.

The telephone is rapidly overtaking the telegraph in the estimation of the London public. During the last year, while there has been a large decrease in the amount of telegraphic work, the telephone did a largely increased business. Greater rapidity and number of postal deliveries, messenger service and the like are also robbing the telegraph service of its former supremacy. The result is that men and expensive plants are lying idle. Telegraphists themselves seem to have recognized that the future of their service depends on its recovering its popularity, for at their annual conference, held recently in London, there was adopted a resolution in favor of three-penny telegrams.

THE LONG DISTANCE TELEPHONE IN MEXICO.

Referring to the progress being made by the long distance telephone in Mexico, the Mexico City *Herald* says: "Experiments have already been made with the long distance telephone between the capital of Durango and Toreron, some 254 kilometers, with good result. The wires used for the telephones are the same as used for the telegraph, and during the sending of telephone messages the telegraph service is not interrupted. Later on the modern telephone will connect the cities of Durango, Toreron, Lerdo, Gomez Palacio, Saltillo and Monterey. The telephone from Maravatio to Aporo, Irimbo and Senquio, in Michaacan, has already been inaugurated."

TELEPHONE NOTES FROM ABROAD.

The Jalisco Telephone Company is making many improvements to its telephone system at Chapala, Mexico.

The Sonora Telephone Company of Guaymas, Mexico, is installing a new and complete telephone exchange at that place.

The National Telephone Company of England is inviting public subscriptions for $5,000,000 four per cent debenture stock.

The charge for telephone conversation between London and Paris has been reduced from $2 to $1 for a three-minute talk.

Extensive improvements are to be made to the local telephone system at Merida, Mexico, which was recently badly damaged by fire.

Telephone wires have been laid from the city hall to the hospital, jail and courts of Guaymas, Sonora, in Mexico. The telephone apparatus is being installed now.

There was an enormous increase in the use of the telephone in the German empire in 1903. There were 757,648,580 conversations by wire, an increase of 75,000,000 for the year, or more than 200,000 a day.

The long-distance telephone line between Sidney, C. B., and Halifax, N. S., was formally opened by an exchange of messages between the mayors of Halifax, Sydney, North Sydney, Sydney Mines, Glace Bay and Louisburg.

A project is on foot for running a double circuit telephone line between Berlin and St. Petersburg, passing by Eydtkuhnen and Koenigsberg. It is estimated that the cost of installing the Russian part of the line would be $400,000. As the city of Moscow is now connected with St. Petersburg by telephone, this will offer communication between Moscow and Berlin. Another project is to con-

nect Warsaw with the German telephone system by a special line.

It is proposed to erect an Independent rural telephone system in Ontario, from Thornbury and Clarksbury up to the Tenth Line, taking in Heathcote, Redwing, Ravenna and Kolapore, with possible extensions to Feversham, Duncan and Kimberley.

It is the general belief that disease is spread by the telephone, by the breath condensing on the mouthpiece of the instrument. To prevent this a German inventor puts a pad of paper, with a hole in the center, on the mouthpiece, and the upper disk of paper is torn off after every conversation.

The Glasgow corporation has just decided to make application for a further loan of $250,000 for the purposes of the municipal telephone undertaking. Its borrowing powers up to date have been $1,500,000, of which only $75,000 is unspent. The money now to be borrowed is for connecting up new subscribers.

The 4,000 telephone girls in Germany are government employes. Each must be of good character and live in a respectable family. The pay is 33½ cents a day, with an advance of six cents in two years, and those four years in service secure 71 cents a day. Applicants for these positions usually wait two years for an opening.

The government of the state of Vera Cruz, Mexico, has granted a concession to A. Espinosa of the city of Vera Cruz for the establishment of a complete telephone system there. It is stipulated in the concession that the service shall be first-class in every respect and that prices shall be lower than are charged by the company now doing business in Vera Cruz.

The success of the electrophone in various London churches—hundreds of members of which now, in case of sickness, are able to listen to the sermons of their favorite ministers without leaving their homes—has suggested the idea of installing electrophones in Westminster Abbey and St. Paul's Cathedral. There is, however, opposition among conservatives, who think that a modern invention of this kind would desecrate a temple like the Westminster Abbey.

For some time the introduction of the telephone in Canton, China, has been talked of, and is now said a system has been installed, the arrangement being in the hands of the imperial authorities. All the large yamens will have the advantage of this new departure, and many large dealers and banks will also be provided for. It may not be generally known that some years ago the telephone was introduced in Shameen, but very high charges were made and the enterprise proved a failure.

Turnice de Montebello, of Paris, nephew of the former French minister to St. Petersburg, is generally applauded as the savior of telephone victims by founding a league for the defense of telephone users in Paris. He has defrayed from his own pocket the expenses of sending circulars to 30,000 subscribers in Paris, and is daily receiving bags full of letters from abused telephone users. The first action of the league will be to suppress official despotism in cutting off a wire arbitrarily on any pretext and to reduce the yearly rate from $80 to $60.

The Department of Communications and Public Works of the Mexican Government has ordered the construction of an extensive system of telephone lines in the Yaqui district, State of Sonora. It is proposed to connect every town and hamlet in that district with telephone communication. This action is taken in order that the movement of troops in pursuit of Yaqui Indian outlaws may be expedited and also to help in the settlement and development of that rich region. The Secretary of Communications and Public Works, City of Mexico, can give information in regard to the proposed work.

The Belgian Telegraph and Telephone Administration has recently put down a quantity of Camp's conduit for telephone purposes. Some 600,000 feet was supplied to the city of Brussels, and further extensions in that city and at Antwerp and Liege have resulted in additional orders of 825,000 feet being placed with the same firm (H. B. Camp & Co., New York). Over 1,000,000 feet of this conduit were put down in St. Petersburg during 1903. The chief office for Europe is 27, Chancery Lane, London (Messrs. Cumming & Woodman, agents); the Continental agent, Douglas Wells, 10 Rue de la Pepiniere, Brussels.

INDEPENDENT COMPANIES WILL COMBINE IN EASTERN NEW YORK.

With a view to making long-distance connection with Syracuse, Utica, Rochester, Binghamton, Buffalo and other towns of New York, Pennsylvania and Ohio, action has been taken at Troy for the consolidation of the Rensselaer Telephone Company of Troy, the Saratoga Telephone & Telegraph Company of Saratoga Springs, and the New Union Telephone Company of Glens Falls. The new company is to be known as the Commercial Union Telephone Company. The officers are: President, John T. Christie of Troy; secretary, W. N. Burk of Glens Falls; treasurer, Peter McCarthy of Troy. The necessary action on the part of the old companies, it was announced, will be taken immediately.

It was said that before the end of the coming summer the long-distance connection would be made with Syracuse. The companies now have about 3,500 telephones in use.

It is the intention at once to extend the lines north to Plattsburg, east to North Adams and other Massachusetts cities, and west at an early date and form alliances so that in a few months direct connections can be made as far west as St. Louis.

TELEPHONE MAP OF IOWA.

If one thing is more needed than another to set before the business men of the country the extent of Independent telephone lines it is accurate maps. We are informed that Henry S. Herr of Ottumwa, Iowa, president of the Iowa Telephone Association for 1903 and 1904, is sending blanks to the telephone companies of the state for plats of their lines to be used in compiling such a map. Every company should give its support and co-operate by promptly furnishing the information asked for. Every company in the state is requested to make a diagram of its lines and send a copy to Dr. Herr at Ottumwa.

A PAY STATION.

An amusing incident occured at Urbana, Ohio, recently. A stranger entered a hotel and asked for the telephone pay station. He was shown the booth and he walked in. Pretty soon he came out with an anxious look on his face and said, "Well, where is he?" "Where is who?" asked the hotel clerk. "Why, the man you pay; didn't the papers say that there was a pay station here and I want to pay my telephone rental." The poor innocent mortal was directed to the office of the company and a deep silence reigned as he strolled out. It was a charitably disposed crowd that heard the conversation.

It is stated that as soon as market conditions will permit, the Keystone Telephone Company of Philadelphia, Pa., will ask authorization to issue $5,000,000 bonds, of which $3,500,000 will be sold at once.

Simultaneous Telegraphy and Telephony

E. M. FISHER

Simultaneous telegraphy and telephony, or as it is commercially known, "composite" transmission, is one of the most important, and possibly, just at this time, the most interesting subject that can come to the attention of the telephone engineer. It is a subject of vital importance to wire chiefs and managers, and even toll operators will become more and more involved in the manipulation of the composite apparatus if not in its theory.

Before describing the apparatus and its arrangements by which a metallic circuit can be used simultaneously as two independent telegraph circuits and a telephone talking circuit, it would be well to consider the fundamental principles underlying the accomplishment of an undertaking apparently so impossible. First we will consider the simple "Morse" or telegraph circuit. Fig. 1 shows the apparatus and connections used in this country for the manual transmission of telegrams. In this circuit the ground is used as a return. When both keys *K* are closed, the current from the main battery *MB* flows through both relays *R, R* in the line, returning through the ground. The armatures are drawn toward the energized cores of the relays, closing the contacts *C* in the local circuit, which causes the sounders *S* to repeat or magnify the opening and closing of the relays. It is readily seen that the relay and sounder will now simply reflect the movement of the key, consequently, the Morse character will be transmitted through the key to the sounder at the distant office where it can be read by the operator.

Van Rysselberghe's composite system employs two telegraph circuits as illustrated in Fig. 1, out of which he

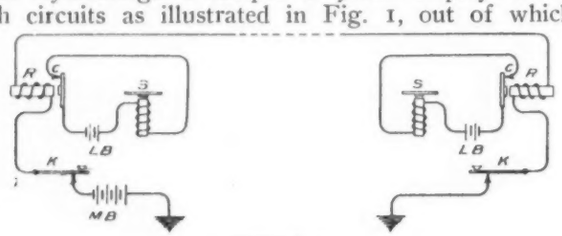


FIGURE 1.

evolves a metallic telephone circuit. Before entering on an explanation of this system, it would be well to study the characteristics of the electric waves of both the telegraph and telephone currents. The apparatus in the first system responds to a direct current, and that in the latter to an alternating current. The success of simultaneous telegraphy and telephony depends upon the non-interference of these superimposed waves of direct and alternating current, therefore the first necessity is to understand the characteristics of the different currents and their effects upon the apparatus. In operating the telegraph circuit described above at a speed of thirty words per minute, the key would be opened and closed about six times per second, in other words, the current from the battery flows to the line and ceases to flow six times in each second, and consequently the current increases from zero to a maximum, remaining there less than 1-12 of a second, the decreases from maximum to zero, remaining there less than 1-12 of a second.

The time required for the current to reach its maximum or vice versa, does not depend upon the rapidity of the opening and closing of the key, but upon the electrostatic capacity, the self-inductance and resistance of the circuit into which the current flows. In the telegraph circuit the electrostatic capacity and self-inductance are practically negligible, and the current would rise and fall almost instantly. In fact, so rapid is the rate of rise from zero to maximum that it requires less than 1-50th of the time required to make a telegraph dot, even in a circuit two hundred miles long.

The lowest audible musical sound is produced by vibrations moving at the rate of about fifteen per second, and consequently any wave moving at a higher rate of speed than fifteen per second would produce a sound in a telephone receiver. It, therefore, follows that as the telegraph wave moves at a rate in excess of the lowest sound wave, it would produce a sound in a telephone receiver. Fig. 2 illustrates

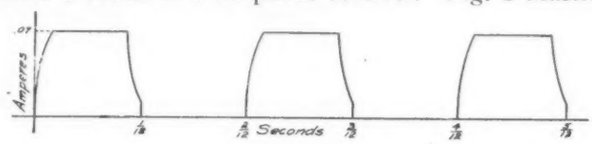


FIGURE 2.

the characteristic of the telegraph wave. The time of the wave is plotted along the line *AT*, and the current along the line *AC*, the maximum current is represented as seventy milliamperes. The point *A* represents the period of closing the key, and the current wave rises in something like the slightly curved rising line. The current remains at maximum, until the key is opened, when it falls to zero, in a little different curve than the rising curve. It remains at zero until the key is again closed, when another wave like the first is made. The length of the crest or the maximum period of the wave depends upon the length of time the key remains closed. As explained, the telegraph wave, when the electrostatic capacity and self-inductance in the circuit are negligible, rises and falls at a rate rapid enough to produce a sound in a telephone receiver, and, therefore, to successfully operate a telephone on such a circuit we must in some way change the character of the Morse wave, and at the same time, not destroy its usefulness.

The time required for a current to reach its maximum depends upon the quantities, electrostatic capacity, self-inductance and resistance in the circuit, or T varies as $\frac{L}{R}$ or times varies as the inductance divided by the resistance. By this equation, to increase the time, we must either increase the inductance or reduce the resistance, or do both.

In a given circuit we cannot reduce the resistance, therefore we are compelled to increase the inductance. Fig. 3

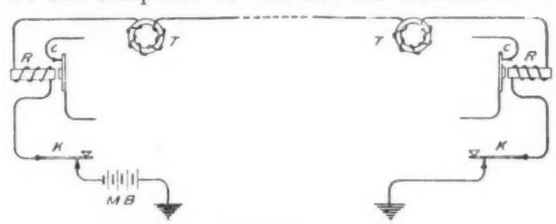


FIGURE 3.

shows the introduction in the telegraph circuit of coils of wire wound on a soft iron ring. The local circuit on the relay point is omitted to simplify the illustration. Current flowing through the convolutions around the ring of iron will produce a counter or opposing current. The reason for this is as follows: The current in passing around the iron ring through the turns of wire creates in the iron ring lines of force which increase as the current increases. This increasing of the number of lines of force creates or gener-

ates in the turns of wire a counter or opposing current, which is proportional to the *rate* at which the lines of force are *increasing*, therefore the initial current and counter current reach their maximum values gradually and not instantly. When the key is opened the lines of force rapidly decrease. This rapid decrease of the lines of force in the iron ring produces a current in the coil of wire, but this time it is in the *same* direction as the initial current, and tends to retard its fall.

The inductance or counter E.M.F. in such a coil (called impedance retardation or choke coil) increases as the square

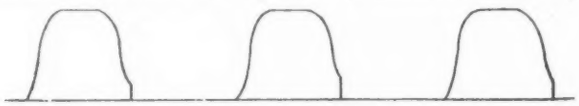


FIGURE 4.

of the number of turns of wire on the iron ring, while the resistance increases only as the number of turns, consequently we rapidly increase the ratio $\frac{L}{R}$ and, therefore, we are able to introduce considerable inductance in the circuit without introducing too great a resistance.

The introduction of this impedance coil in the circuit has now changed the characteristic of the Morse wave and its rise and fall is not at so rapid a rate, being something like that in Fig. 4. It would be possible to design an impedance coil that would so distort the Morse wave as to prevent its interference with the telephone receiver, but it is also possible by introducing too much impedance to so flatten the Morse wave that its efficiency is destroyed.

Another medium used in retarding the rate of the Morse wave is the condenser. In Fig. 5 condensers are shown

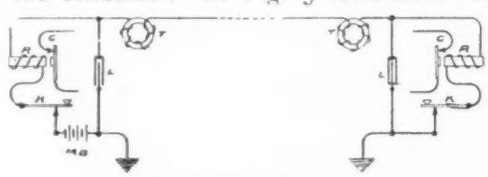


FIGURE 5.

connected across the circuit to ground. It now remains to see what effect these condensers will have. When the key is closed the current flows to line, but the two condensers must become fully charged before the current can reach its maximum in the line, and again we introduce delay in the rise of the current. When the key is open the condensers tend to discharge their current into the line, but the discharge is in the direction of the charging current, and like the current caused by the breaking of the circuit in which there was an impedance coil, the current tends to retard the fall of the Morse wave.

Thus by the introduction of the impedance coils and condensers in the Morse circuit we have so flattened the telegraph current wave, that it assumes about the character illustrated in Fig. 6, and we have so reduced its rate of in-

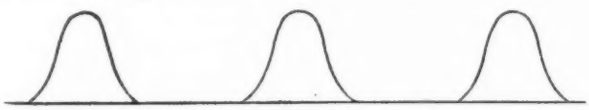


FIGURE 6.

crease and decrease that at the speed of a telegraph operator the rate of vibration is below that of the lowest audible sound.

It is readily seen that it would be impossible to use the rapid automatic telegraph on a circuit wherein has been introduced such impedance to the telegraph wave, and also that there is a limit to the number of stations on such a Morse circuit, even if they are worked at the speed of a telegraph operator. In the first instance not enough impedance has been introduced to interfere with manual operation, but with rapid mechanical operation the current wave would not have time to rise to its maximum before another wave would follow and interfere. In the second instance by cutting in too many offices, each office requiring retardation coils and condensers, so much impedance would be introduced that soon even at the speed of manual operation one wave would follow too rapidly upon another.

Still another reason prohibits the use of the automatic telegraph. If it were possible for each wave to reach its maximum, the rapidity of the automatic sending would increase the rate of vibration to such a degree that possibly it would be at a rate high enough to produce an audible sound in the telephone receiver. If the telephone was bridged directly across the two Morse circuits with a metallic connection it would form a cross between the two Morse circuits and would also allow the undulating current to pass through the receiver, causing the diaphragm to respond to

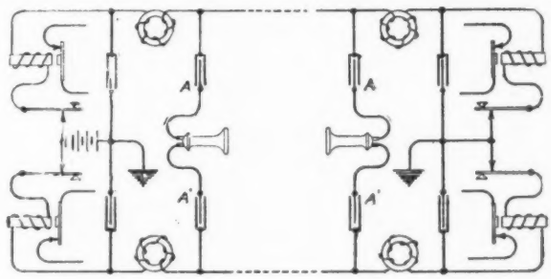


FIGURE 7.

the impulses just as the relay and sounder in the Morse circuit. To prevent this the telephone circuit is bridged through condensers, as in Fig. 7.

A condenser will not allow a continuous current to pass through it. Its resistance to such a current is practically infinite, consequently the condenser has made the telephone circuit an "open" circuit to the Morse current. The Morse current, however, will be constantly charging and discharging the condensers, and these charges and discharges which pass through the receiver will cause the diaphragm to move back and forth, but the rate of change of the direct current is so slow it will not produce an audible sound.

We have now considered and designed a circuit through which the direct current of the Morse system will flow, which will operate the necessary relays and sounders for the transmission of telegrams, and it remains to show that

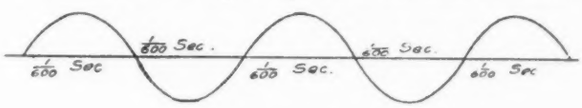


FIGURE 8.

also we have built a telephone circuit over which the alternating current of telephone transmission will pass, going through the necessary telephone apparatus and not interfering with the undulating current of the Morse circuit.

We can safely say that if the alternating current of the telephone did pass freely through the telegraph relays its strength would be so small that it would not affect even the most sensitive telegraph relay.

However, if the alternating current did pass freely through the telegraph relays it would have easy access to the ground and both sides of the telephone circuit being grounded this would put a "shunt" directly across the line and possibly offer a better circuit for its flow than through the wire circuit to the other telephone station. Therefore, we see that it is absolutely necessary to prevent the alternating current from passing through the relay to the ground, and now we will see how the retardation coils introduced to

flatten out the Morse impulses will act as an impedance to the alternating current, and prevent it going to ground.

The resistance to the flow of an alternating current is called impedance. In a circuit over which a direct current is flowing the current is proportional to the electromotive force divided by the resistance, $I = \frac{E}{R}$, while for a simple alternating current the current is equal to

$$\frac{E}{\sqrt{R^2 + (2\pi n L)^2}}$$

where E = electromotive force, R = resistance, $\pi = 3.1416$, n = number of periods or double vibrations per second, and L = inductance in henries of the whole circuit. The value of the expression $\sqrt{R^2 + (2\pi nL}$ is the impedance of the circuit. It is evident from this expression that the impedance increases with the frequency n, and with the inductance L.

In the telegraph circuit through the retardation coil there were about 6 rises and falls in current per second, while in the ordinary telephone conversation there are about three hundred complete vibrations or periods per second of the sound waves, or about one hundred times as many as in the Morse current. If in designing the retardation coil to flatten out the Morse wave at a frequency of six per second we have succeeded to such an extent that it has no effect on a receiver, we can readily appreciate the great impedance this retardation coil will offer to the alternating current, and consequently the line and receiver at the other end will offer an easier path to the flow of alternating current and most of it will follow that course.

To show clearly what "impedance" is some explanation will be given. Fig. 8 shows approximately the character of an alternating current wave. It will be noticed that at all points of the period or cycle the current is either rising or falling above the line or falling and rising below the line. In noting the effect of the iron ring wound with coils of wire (retardation coil) while considering the Morse circuit we saw that a counter or opposing electromotive force was created by the rising and falling of the direct current and that this counter electromotive force was greatest at the point of the greatest rapidity of rise and fall and was only momentary in its flow. If the frequencies are slow the initial flow lasts longer than the counter E.M.F. and consequently passes through the coil in a flattened form. Suppose we increase the frequency of the initial flow until it died out on each impulse as quickly as the counter E.M.F. ceased, the result would be that no current would flow

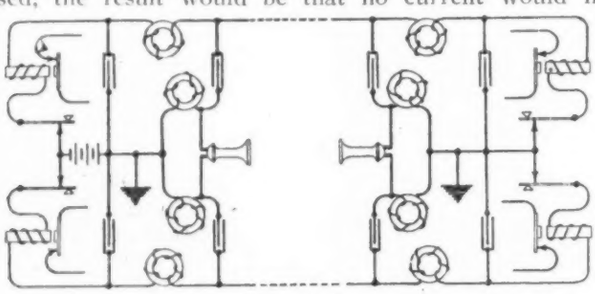


FIGURE 9.

through the coil if the counter E.M.F. was at all times equal to the initial E.M.F., and to all practical effects that is what happens in the composite circuit. The retardation coil effectually blocks off the rapidly alternating current so that it is forced to flow through the line and receiver at the other end, thereby transmitting the telephone sound waves. The telegraph relay offers impedance to the alternating current, its electro-magnet being coils of wire around an iron core, and it also tends to prevent the alternating sound waves from passing to ground. Through the two effective impedances very little of the alternating current passes to ground, and consequently when we "composite" a metallic circuit we lose very little of the telephonic efficiency.

Only one point now remains where there might be interference between the telegraphic and telephonic use of the same metallic line. In Fig. 7 at the points marked A and A^1, it may be noted that it is possible for a high difference of potential to exist, the condenser A being charged from a high voltage current on the Morse circuit on its side of the line and the condenser A^1 with a high opposite potential from the Morse current on the other side. There would be

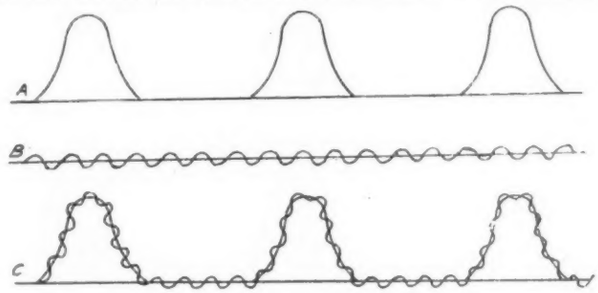


FIGURE 10.

a tendency for an equalization or leveling of this difference of potential through the receiver, possibly sufficient to produce a flutter in the receiver. To equalize this difference of potential we will shunt the receiver through low resistance retardation coils to ground. (See Fig. 9.) By this means the difference of potential is equalized, and at the same time the receiver is not shunted to the alternating current, as the retardation coils offer infinitely higher resistance to the alternating current than does the receiver; hence

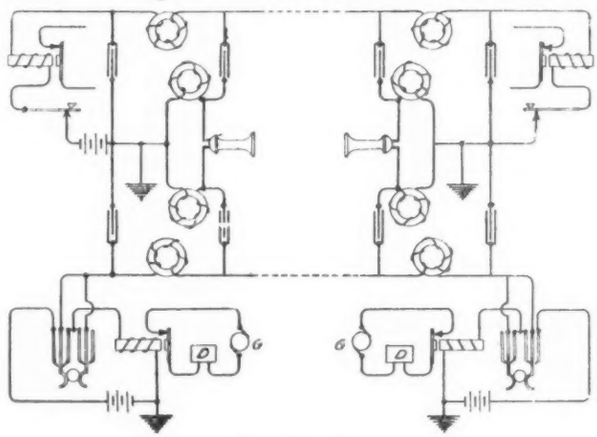


FIGURE 11.

the alternating current takes the easiest course, passes through and actuates the receiver. Fig. 10 gives a graphical impression of how two current waves would pass over the line, A being the form of the telegraph current wave, B the form of the alternating voice wave, and C the superimposed waves.

An arrangement has now been provided which will make two telegraph circuits and one metallic telephone circuit from a pair of wires. It remains to see if we can "ring" over such a circuit and if not, how we can accomplish a result so necessary. There have been many schemes and patents covering methods by which this end can be accomplished. We will discuss but one. The frequency of the alternating generator current is very low as compared with the frequency of the alternating telephone current, and the generator current will easily pass through the retardation coils and telegraph relays, and it might possibly be of enough strength to actuate the telegraph relay. This would seriously interfere with the telegraph signals and at the same time the greater portion of the generator current would flow to ground through the telegraph circuits, as they offer

less resistance to the flow of current. Consequently not enough current would go to the distant office to actuate the drop.

A simple way to ring over a circuit is to give up one of the telegraph circuits for the purpose. This requires very little extra apparatus, but does require a special ringing key and drop for each circuit. Fig. 11 shows how the telegraph circuit is made a ringing circuit. It will be noted that there is no battery on the ringing circuit, but that both ends are grounded through the telegraph relays. Inserted in this circuit at either end is a spring key carrying on its outside spring a grounded battery. When the key is in normal position the circuit is through the shift and inside spring to the telegraph relay. When thrown it opens the relay circuit behind it and puts the grounded battery to line. This battery finds ground and completes its circuit through the key and relay at the distant office, and the distant relay responds, closing the local contact point. Instead of a local battery and sounder being in series with this contact point as in the telegraph circuit, a power generator and drop are inserted. When the contact point closes the generator circuit is completed, and the drop falls. When the key is released it again closes the relay circuit, making it complete for the distant office to ring through.

A DIFFERENTIAL TELEPHONE.

1. The authors have tested the merits of a differential telephone as a means of measuring a self-inductance, and have devised an exceedingly accurate method of measurement. The differential principle has been used before in connection with a telephone,[2] but the accuracy claimed for it in the measurement of a self-inductance was only about one per cent. With the instrument described below, an accuracy greater than one-fiftieth of one per cent has been attained.

2. A differential telephone receiver is one of the bobin (or bobins) of which two coils AA' and BB' are wound side by side. By suitable means these coils are adjusted so as to have equal self-inductances and equal resistances, and so that the magnetizing effect of a current flowing through one coil from A to A' is exactly annulled by that of an equal current flowing through the other coil from B to B'. A variable self-inductance standard S is joined in series with coil AA', and the coil of unknown self-inductance X in series with coil BB'. A non-inductive variable resistance R is inserted in series with S or X according as the resistance of X is greater or less than that of S. The two entire circuits are then joined in parallel and an alternating electromotive force is applied to the branch points C and D. By varying R and S values can be found easily such that no sound is heard in the receiver. When this is the case the two parallel currents must be equal to, and in phase with each other, and therefore the self-inductance of X must equal that of S.

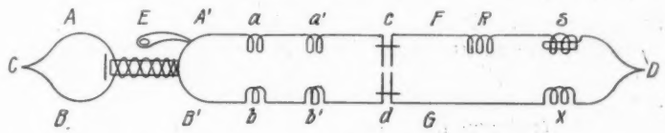
[1]Presented at the St. Louis meeting of the American Association for the Advancement of Science, December, 1903.
[2]H. Ho, Electrical World and Engineer, May, 1903.

3. Before the instrument is ready for use, three adjustments are necessary, but these may be made once for all, and do not have to be repeated before each measurement.

First, the magnetic effects of the two receiver coils must be equalized. This is the most difficult adjustment, as it is impossible to wind the two coils exactly alike. The equality of the magnetic effects can be tested by joining the ends A' and B together, and sending an alternating current through the two coils in series in the direction $AA'BB'$. The same current then passes through each coil in the proper direction, and the magnetic effects are equal and opposed to each other, if no sound is heard in the receiver. In making the receiver it is best to wind the two coils side by each and as close together as possible, and each layer of turns should be evenly distributed. If in the first layer the turns belonging to coil AA' are nearer the diaphragm than those belonging to coil BB', in the second layer the positions of the turns belonging to the respective coils should be reversed, and so on alternately in the succeeding layers. Even with this careful winding the magnetic effects are not exactly equal to each other; in our instrument the difference between them amounted to the effect of a fraction of a single turn. A number of schemes for balancing the residual effect were tried, but the only one that completely extinguished the sound in the receiver was the insertion of a small coil E of about ten turns of wire in series with one of the receiver coils. E was mounted on the frame of the receiver in such a way that it could be shifted about with its plane always parallel to the common axis of the coils AA' and BB'. A position could be found for E that completely extinguished the sound, even though an alternating electromotive force of twenty volts was applied to the coils.

The second and third adjustments are the equalizations of the resistances and self-inductances of the coils. The self-inductances can be equalized by placing in series with each receiver coil a pair of coils (aa' and bb'), and by altering the distances between the coils in each pair. The resistances can be equalized by means of sliding contacts moving along pairs of parallel wires (c and d). The test for the equality of the resistances and of the self-inductances is accomplished by joining the circuits from A to F and from B to G in parallel, applying an alternating electromotive force to the branch points and varying the adjustments until no sound is heard in the receiver. After these adjustments have been made the instrument is ready for measurements.

4. In comparing the self-inductance of a coil X with



that of a standard S two balances must be made. The resistance of the parallel circuits must be made equal to each other by varying R, and the self-inductances equal to each other by varying S. One of these balances does not depend upon the other (as is the case, for instance, in Maxwell's method of comparing a self-inductance with a capacity), and hence the double balance is much easier than it otherwise would be.

If the divisions of the resistance box R are not small enough, the final balance of the resistances may be made by means of the sliding contacts c and d.

Absolute silence in the telephone receiver can be obtained easily, if there is no iron in the self-inductance. With an iron core a very sharp minimum can be obtained, but not in general total silence. If, for instance, the coil X is a Morse telegraph sounder, several tones of different pitches can be heard, and values of S and R can be found that extinguish the most prominent tone.

5. The accuracy of the measurement may be estimated by means of the following calculation: Suppose that the resistance of the two parallel circuits are equal to each other and each equal to r, and further that the reactances of the two circuits differ from each other by the small amount dx, x being the reactance of one circuit and $x + dx$ that of the other. The complex expressions for the impedances of the two circuits are

$$(j = \sqrt{-1}).$$
$$Z_1 = r + jx, \quad \text{and} \quad Z_2 = r + j(x + dx).$$

If e is the simple alternating electromotive force applied to

the branch points C and D, and I_1 and I_2 are the currents in the two branches respectively,

$$I_1 = \frac{e}{r + jx}, \quad \text{and} \quad I_2 = \frac{e}{r + j(x + dx)}$$

The sound heard in the receiver depends upon the difference between the two currents, and, if dI is this difference,

$$dI = I_1 - I_2 = e\left(\frac{1}{r + jx} - \frac{1}{r + j(x + dx)}\right).$$

Reducing to a common denominator, neglecting small quantities of higher orders than dx and eliminating the imaginary unit j, we find that the absolute magnitude of dI is

$$dI = \frac{e\,dx}{r^2 + x^2}.$$

If dI is the smallest current that can be detected, when it flows through one of the receiver's coils, dx cannot be greater than

$$dx = (r^2 + x^2)\,\frac{dI}{e}.$$

To estimate the numerical value of the accuracy assume that the resistances r and the reactance x are each 50 ohms, that e is one volt and that a current of one millionth of an ampere can be detected by the telephone. These values are not unusual. Then

$$dx = \tfrac{1}{200}\ \text{ohm},$$

and the percentage error is

$$100\,\frac{dx}{x} = \tfrac{1}{100}\ \text{per cent.}$$

The reactance x may be taken to be that of the standard S alone, for the reactance of the rest of the branch circuit is very small. The reactance is due to self-inductance, and therefore the percentage error in the measurement of the self-inductance is also 1/100 per cent.

As a matter of fact the accuracy does not fall far below the theoretical value. It is not difficult to measure a self-inductance to within one-twentieth of one per cent, and with care the accuracy can be considerably increased.

6. Electrolytic resistances also may be measured by means of the differential telephone. For this purpose the coil X is replaced by a vessel with suitable electrodes and containing the electrolyte, and the standard S is removed.

7. The advantages of using a differential telephone as described above for measuring a self-inductance are: (*a*) that the apparatus is portable and does not get out of order easily; (*b*) that great accuracy can be attained and the manipulation is not difficult; (*c*) that the heating of the circuits by the currents does not alter the self-inductance balance, and therefore that large electromotive forces may be used; and (*d*) that only one standard is required; it is not necessary to know the values of any resistances or the lengths of a bridge wire. The disadvantage is that the self-inductance of the standard must equal that of the coil to be measured. If, however, the self-inductance to be measured is smaller than the smallest inductance obtainable in the standard, a fixed standard may be placed in series with the unknown coil, and the sum of their self-inductances measured; and if the self-inductance to be measured is greater than the greatest inductance obtainable in the standard, a fixed standard may be placed in series with the variable standard. Thus the range of measurement may be increased indefinitely beyond the limits of the variable standard.—*Physical Review.*

Colonel Hiram M. Carpenter, an inventor of electrical devices, died in New York on March 29. He invented and improved storage batteries, and lately had been engaged upon a wireless telephone. Mr. Carpenter was born in Williamstown, Massachusetts, 64 years ago and was related to the late United States Senator Matthew Carpenter. He gained his military title in the civil war.

INFLUENCE OF THE FARM TELEPHONE.

The telephone has ceased to be a purely urban convenience. It has become an important factor in the rural life of many sections. A talk by wire with the farmer of New England is an every-day occurrence. Calling up a plantation owner in the blue grass region of Kentucky has ceased to be a novelty and perhaps before very long the farmers of the far south will be saying "Hello!" to New York.

In Connecticut alone the telephone companies have established about 6,000 farm stations and the number is rapidly increasing. At a cost of $18 a year the farmer can place himself in constant and immediate touch with the town and city, receiving market quotations and advice every day, and selling or ordering goods without moving outside of his own home.

The farm telephone is the outgrowth of a crude system, which had its inception in the discovery that the ordinary wire fence could be utilized for telephone wires. By insulating the top wire of the fence messages could be sent from one part of the farm to another. Crude transmitters and receivers were connected, and in a short time farmers co-operated in extending their private wires. In the west, where many miles of barbed wire fences were used, contiguous farms were connected by telephone at comparatively little expense. By running wires over the highways, stringing them from trees, a pretty effective system could be obtained. Hundreds of thousands of farms were connected by telephone through the co-operation of the owners, and the fence suddenly became an improving factor that the manufacturers never anticipated.

The telephone companies have now entered into partnership with the farmers, and the rural service of many of the companies is more extensive and valuable than the town service. Better wires are used, superior instruments employed, and better general service is maintained all around. The whole country is in a fair way to be gridironed with wires.

The farmer's telephone makes him independent of the rural free mail delivery and the railroad and telegraph companies. Market quotations are received in tens of thousands of country homes only a few minutes after they are sent over the ticker to the offices of commission men. No bull or bear move on the market can be made by operators in grain, provisions or dairy products without instantly being communicated to the producers. The farm service attempts to spread the news of the market each day so that the farmers can draw their own conclusions respecting any violent break or advance in prices.

To make the service more complete the rural companies have arranged for sending a complete gist of the day's news happenings to their customers. Thus a farmer after the day's work can sit in his own home and listen to an intelligent description of the chief events in the world.

A further step in bringing the farms into closer communication with the town has been agitated by congress. This is facetiously called the telephone mail and is intended to make rural free delivery antiquated and slow in comparison. When a farmer expects a telephone letter he directs the postmaster to the nearest office to open it immediately upon receiving it and telephone the contents to him. Telephone letters can be sent with a special delivery stamp attached. This indicates that the postmaster is to open the letter and telephone its news to the farmer situated anywhere from a mile to fifteen or twenty miles away.

Some of the most enterprising rural telephone companies are making arrangements to give entertainment to the farmers in their lonely homes by connecting the wires with concert halls and lecture platforms at certain hours of the evening after the business of the day has been transacted, and when the wires are no longer in demand.—*New York Times.*

Telephone Tales Tersely Told

Business men at Hanska, Minn., have put up $5,000 for a local telephone system.

The Independent companies of Flora, Delphi, Frankfort, Logansport and Kokomo, Indiana, have united for mutual protection.

Work has begun on the new $16,000 building of the Vermilion County Telephone Company at Danville, Illinois. H. B. Walter has the contract.

The South Bend (Ind.) Home Telephone Company has purchased the property of the Electric Investment Company of Mishawaka, Indiana, paying therefor $14,000.

A fire on April 16 damaged the Connersville (Ind.) telephone exchange to the amount of $2,000. Manager L. A. Frazee says that crossed wires caused the blaze.

The Eldon (Iowa) Independent telephone company, with about 250 miles of lines through Wapello, Davis, Jefferson and Van Buren counties, has been sold to Sioux City parties.

Representatives of all the Independent telephone companies of Kansas are asking the State Board of Railway, Telegraph and Telephone Assessors that their rate of assessment be reduced.

Prominent business men of Iowa City, Iowa, are interested in a new telephone company, with a capital of $100,000, that has entered the Johnson County field, and an active rate war is expected.

The Kinloch Telephone Company of St. Louis announces that its line to Carthage and Joplin will be completed by June 1. In the "zinc belt" the Independent companies show great increase in earnings.

The contract for rebuilding the Mutual Telephone Company's exchange at Des Moines, Iowa, has been let to the Stromberg-Carlson Company of Rochester, New York. The cost will be close to $250,000.

The Red River Telephone Company which controls the Fargo and Moorhead connections with the Northwestern Telephone Company, is preparing to build lines to various centers in the surrounding country.

The Union Telephone exchange of Prairie du Chien, Wis., has been sold to J. W. Callaway of LaCrosse, Wis., for $7,000, and is to be worked in connection with a string of exchanges in cities in that part of the state.

Herman E. Wilson, a conductor on the Fort Wayne and Southwestern Interurban Railroad, was killed at Fort Wayne, Indiana, by an electric shock received while attempting to use the portable telephone carried on the car.

An unusual situation exists in New Decatur, Alabama, where three telephone companies have recently had their franchises revoked. It is expected that the next move will be an injunction against the city. The Morgan County Telephone Company (Independent) is now in sole possession of the field. There was a rate war between the Morgan company and the Southern Bell when the Morgan company started up a year ago.

The Board of Health of San Francisco is urging the passage of an ordinance enforcing the attachment of bacteria-proof mouthpieces to all telephones in that city. The object of this is to prevent the spread of contagious diseases.

The Citizens' Telephone Company in Clinton, Indiana, is unable to supply the demand for telephones. Two new lines recently entered that city, and two now are being put up in the western part of the township near Jacksonville and Scotts.

The E. H. Martin Telephone Company of Webster City, Iowa, will reorganize with a capital stock of $300,000, retaining its present headquarters. The Martin Company is one of the strongest Independent telephone companies in the state, covering eight counties.

By a fire in the Rapid Transit subway, at Fulton street and Broadway, New York City, all fire alarm wires south of Fulton street were rendered useless, 11,000 telegraph and telephone wires were put out of commission, and damage to the amount of $500,000 was done.

Four of the seven girls in the Northwestern Telephone exchange at St. Cloud, Minnesota, struck because the managere reprimanded one of them for chewing gum. After remaining on strike for several days a compromise was finally effected and the girls returned to work.

The Interstate Telephone Company is installing a new plant at Peoria, Illinois. There are already nine miles of conduits laid in the city, and the work will be one of considerable magnitude. John Davis, late of Springfield, Illinois, is superintending the work of construction.

The telephone fight in Independence, Kansas, is raging hot and furious, as much so as in Kansas City. The greater portion of the merchants have decided to use only one telephone and have decided to disconnect the Bell telephone on May 1, having given public notice to that effect.

The Merchants and Manufacturers' Exchange of Port Huron, Michigan. has induced 500 telephone users to order out their telephones if the Michigan State Telephone Company insists on raising the rates. It has been suggested that Port Huron and Detroit join in petitioning the governor for a special session of the legislature to fix telephone rates.

The new telephone law in South Carolina, just passed by the state legislature, places all telephone companies under the supervision of the corporation commission. On account of alleged conflicting clauses, it is said, the bill will scarcely be effective. The commission has already applied to the attorney-general for an interpretation of the measure.

For the first time since Tuesday, January 19, the people of Chariton, Iowa, have telephone service. At that time the wires of the Charlton Telephone Company were all broken down by a terrible sleet storm, and it has taken over two months to repair the damage. The new system which

the company has installed is far superior to the one which was destroyed.

Telephone lines to enable the members of the Chicago fire department to communicate with the pumping stations and regulate the flow of water through the pipes have been provided for. It is proposed to have 200 telephones in the system, some of which will be portable, to be carried to the scene of fire, placed on tripods and connected with the wires leading from the pumping stations and the headquarters of the fire department.

It is said that the Warner Telephone Company, recently organized in Gowanda, New York, with a capital stock of $50,000, will in the near future install an up-to-date telephone exchange, which will connect with the long-distance toll lines of the Inter-Ocean Telephone & Telegraph Company for long-distance service, and will build local lines from Gowanda to South Dayton, Silver Creek, North Collins, Cattaraugus, Springville and Arcade.

The E. H. Martin Telephone Company will reorganize with a capital stock of $300,000, retaining its present headquarters in Webster City, Iowa. It is a fact not generally known that this company owns and operates the Postal Telegraph lines in that section of the state, as well as leases to other parties nearly 1,000 miles of telegraph lines. The Martin company is one of the strongest Independent telephone companies in Iowa, covering eight counties.

Just so sure as the "constant dropping water wears away the biggest stone" is the Independent telephone making its impress on the vulnerable Bell monopoly. At first it seemed a hopeless task, but the Independent infant of a half score years ago is to-day a giant in size, with justice and right on its side—in every respect a foeman worthy of the steel of the Bell octopus. Nor does it take a Solomon to see which side ultimately will wear the laurels of conflict.

Indians of the Laguna and Acoma pueblos, situated in Valencia County, New Mexico, are to have a telephone system. Superintendent Allen of the Indian school at Albuquerque states that 46 miles of wire will be strung, the Indians doing the work and the government furnishing the material. The Indians, it is said, are very enthusiastic over the proposed line, which will be the first Indian telephone line in the United States.

Telephone men in Cleveland believe that the measured service will come into general use within a short time. They say that there is too much useless conversation over telephone lines, and it all costs someone something. When the measured service is brought into use, the cost of all conversations will be placed where it belongs. It is believed that a more satisfactory service can be maintained where telphones are used only when necessary.

Headquarters for the Pioneer Telephone Company of Oklahoma City, Oklahoma Territory, recently organized with a capital of $3,000,000, has been established. The work of extending the lines of the company will be begun at once, and it is the intention to cover every city in the two territories and north Texas, and have connections with all parts of the United States, with direct lines to Kansas City, Omaha, St. Joseph, St. Louis and Dallas.

The Western Independent Telephone Company, which is allied with the Kansas City Home Telephone Company, has opened long-distance connections with Topeka, Abilene, Manhattan and Holton, Kansas. Connection will soon be made with St. Joseph, Atchison and Olathe and work is rapidly progressing on the line which will connect St. Louis, Sedalia, Jefferson City, Nevada, Joplin and Carthage, Missouri. The board of directors is planning still further extensions.

A war has been declared on the Bell Telephone Company by the merchants of Jonesboro, Indiana. Two companies have franchises to operate—the Bell and the Independent. The merchants grew tired of the dual systems, and adopted the Independent. The Bell Company's telephones have all been ordered out of places of business and a rule passed that any merchant in the future who uses a Bell telephone in his business or at home will be expelled from the association.

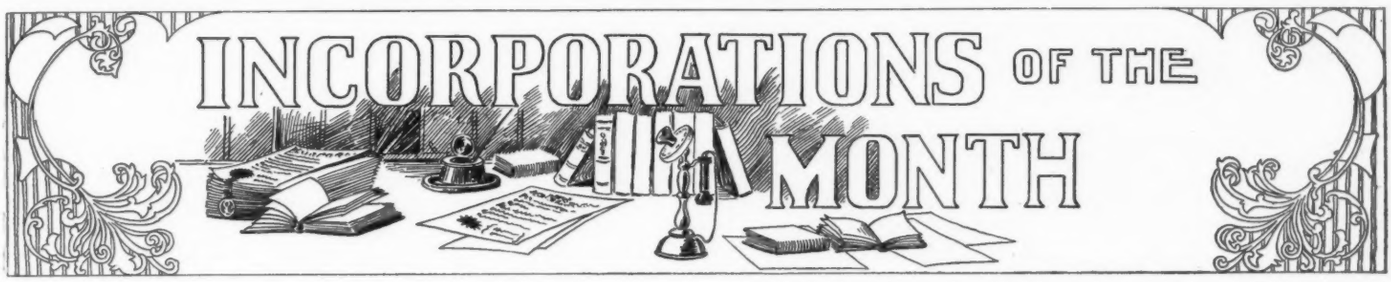
At Flushing, Long Island, fire broke out in the building occupied by the New York and New Jersey Telephone Company. The flames started in the battery room, on the second floor. That room is also used as a sleeping apartment and two operators, Miss Cooke and Miss Barto, had just retired for the night. They were aroused by the fire and ran into the street in their night clothes, carrying their other garments in their arms. The fire was extinguished before much damage was done.

It is stated by the management of the Independent Telephone Company at Salt Lake City, Utah, that by May 1 its system will be in operation in Salt Lake and Ogden and that by that time the company will have expended $1,000,000 on construction work. Buildings in both cities are now almost ready for occupancy. A switchboard which will accommodate 12,000 connections is being installed there. The plans of the company include the invasion of Idaho and Montana within the next year.

The Home Telephone Company of Logansport, Indiana, has just purchased an additional switchboard to increase its capacity. Already the company has let the contract to lay a number of additional cable lines. The company has also connected up a dozen or more village and town exchanges and a score more are applicants. These village exchanges each have from 150 to 200 farmer lines and the service afforded is proving so satisfactory that every small exchange in the Home company's large territory is seeking connection. These branches will be taken on as fast as cable lines can be constructed.

Five years ago the Ogle County Telephone Company opened an exchange at Rochelle, Ill., with eighty subscribers. To-day the company has over 2,000 telephones in operation in Ogle county, all of which the Ogle Company subscribers have connections with free of toll charges. In addition to this most valuable service the company has toll connections with the Rockford Home Telephone Company, Freeport Home Telephone Company and the Inter-State Telephone and Telegraph Company, which own and control the best equipped copper toll lines in Illinois, and in connection with this system patrons have available more than 50,000 telephones. The service is reported to be most excellent.

The Retail Merchants' Association of Independence, Missouri, representing a majority of the business men of that town, has voted unanimously to disconnect its Bell telephones on May 1. The association has about sixty members, and all but three or four are favorable to the action. In referring to the heartless, monopolistic methods of the Bell Dr. W. F. Morrow, a member of the association, said: "My Bell telephone has been disconnected since April 1. The telephone girls tell people who call up on that line that my telephone is 'busy.' Last Saturday night they said that I 'was not at my house' to answer the call of a patient who died the next morning. The Bell monopoly even barters life and death to accomplish its ends."



Elwell Telephone Company, Elwell, Mich.

Home Telephone Company, Chehalis, Wash.

Duncombe Telephone Company, Duncombe, Ia.

Riverton Telephone Company, Sharptown, Md., organized.

Hillsdale Telephone Company, Rice, Kans. Capital stock, $2,500.

Verdigris Telephone Company, Verdigris, Nebr. Capital stock, $10,000.

Home Telephone Company, San Diego, Calif. Capital stock, $500,000.

Guide Rock Telephone Company, Guide Rock, Nebr. Capital stock, $1,000.

Blue Earth Telephone Company, Lake Crystal, Minn. Capital stock, $25,000.

North Lincoln Telephone Company, Harrisburg, S. D. Capital stock, $10,000.

Redding, Ingot and Wengler Telephone Company, Redding, Calif. Capital stock, $10,000.

Goteba Telephone Company, Harrison, Okla. Capital stock, $10,000. Directors, H. Dalke, W. H. Kuda and others.

Fidelity Telephone Company, Wyoming, Ill. Capital stock, $25,000. Incorporators, A. L. Johnson, A. B. Hoff, T. F. Miller.

Edgmoor Telephone Company, Edgmoor, S. C. Capital stock, $25,000. H. B. Heath, president; J. D. Glass, secretary and treasurer.

Hawleyton Telephone Company, Binghamton, N. Y. Capital stock, $500. Incorporators, Geo. W. Vosburg, K. M. Jaycox, C. S. Gage.

Pittsburg and Wheeling Telephone Company, Charleston, W. Va. Capital stock, $100,000. Incorporators, J. G. Splane, R. C. Hall and others.

Camden Co-operative Telephone Company, Camden, Ohio. Capital stock, $4,000. Incorporators, U. D. Teash, C. E. Baker, F. C. Armet.

Farmers' Co-operative Telephone Company, Danville, Ind. Capital stock, $10,000. John F. Hardwick, president; A. C. Underwood, secretary.

Commercial Union Telephone Company, Troy, N. Y. John T. Christie, president; W. Levis Burke, secretary; Peter McCarthy, treasurer.

Gilbert and Story City Telephone Company, Story City, Ia. Geo. P. Brown, president; Thomas J. Thompson, secretary; L. O. Tegland, treasurer.

Farmers' Mutual Telephone Company, Knierim, Ia., organized. F. R. Anderson, president; Clark Richardson, vice-president; W. E. Clagg, treasurer.

Leoni Telephone Company, Leoni, Mich. Capital stock, $475. Directors Z. J. Davis, N. A. Beebe, Charles Gregory, Seth J. Sargent, Julius H. Krumry.

Reading and Rock Stream Telephone Company, Watkins, N. Y. Capital stock, $10,000. Incorporators, Charles Chapman, H. H. Smith, H. S. Howard.

Dundee and Crystal Springs Telephone Company, Dundee, N. Y. Capital stock, $5,000. Incorporators, Belmar J. Knapp, Lyman Pitcher, Edwin J. Bailey.

Elkhart Mutual Telephone Company, Elkhart, Ia. Capital stock, $10,000. Incorporators, O. F. Mathis, Albert Peterson, W. D. Cory, R. H. Ault, A. P. Besser.

Hamlin Telephone Company, Hamlin, N. Y. D. R. Singleton, president; Christopher Rath, vice-president; H. F. Newman, secretary; Charles Baase, treasurer.

Stockmen's Telephone Company, Valentine, Nebr. Capital stock, $10,000. C. S. Reese, president; W. S. Jackson, vice-president; A. M. Morrissey, secretary-treasurer.

Home Telephone Company, Albion, N. Y. Directors, Chas. M. Beattie, Garrison Babcock, G. R. Fuller, Joseph W. Taylor, Guy A. Merrill, Thomas A. Kirby, H. J. Bailey.

Fulton Independent Telephone Company, Fulton, Ind. Capital stock, $15,000. Charles Becker, Sr., president; Elmer E. Jackson, vice-president; William Troutman, treasurer; Henry Becker, secretary.

Blue Hill Telephone Company, Blue Hill, Kans. Capital stock, $2,000. M. Brown, president; Cyrus Gaston, secretary; John Marzolf, treasurer; James Humes, business manager.

Carney Automatic Telephone Company, Carney, Okla. Capital stock, $10,000. Incorporators, M. A. Smith, G. Z. Page, Hugh Dean, C. E. Wilcox, H. Stump, Russ Thomas, E. M. Ball.

East Fairmont Telephone Company, Fairmont, W. Va. Capital stock, $50,000. Jas. L. Devenney, president; W. S. Haymond, vice-president; P. R. Gailmard, secretary; H. R. Eckerman, treasurer.

ARKANSAS.

CAMDEN—Ouachita Telephone Company. Capital stock, $25,000. President, M. A. Joy.

MARVELL—Marvell Telephone Company. Capital stock, $20,000. Incorporators, H. C. Daniel, E. E. McMurray and others.

COLORADO.

AKRON—Washington County Telephone Company. Capital stock, $5,000. Incorporators, C. D. Pickett and others.

FLORIDA.

ST. PETERSBURG—West Coast Telephone Company. Capital stock, $10,000. Stockholders, John D. Darry, Horace B. Webster, Amos P. Avery, Leroy B. Scott, Ralph Q. Raymond.

ILLINOIS.

CARTHAGE—Mississippi Valley Telephone Company.

MIDDLETOWN—The Middletown Mutual Telephone Company. Capital stock, $2,000. Incorporators, J. C. Lloyd, P. J. England, Thomas Dorgan.

CAMPUS—Campus Telephone Company. Capital stock, $2,500. Incorporators, J. D. Brophy, M. R. Walsh, N. L. Mamer, T. P. Maquire, L. E. Walsh, A. J. Harrington.

EDWARDSVILLE—Oak Grove Telephone Company, organized.

NEW HOLLAND—New Holland Telephone Company. Capital stock, $2,000. Incorporators, James W. Collins, P. E. Kuhl, L. C. Schwerdtfeger.

INDIANA.

DALEVILLE—The Daleville Telephone Company. Capital stock of $10,000. Directors, Thomas Bromley, F. D. Rushing, R. E. Stone. Capital stock, $25,000.

FT. WAYNE—Moellering Constructoin Company.

WAWPECONG—Wawpecong Home Telephone Co. Capital stock, $1,000. Directors, M. D. Hensler, Taylor H. Hamilton.

BORDEN—Laurel Telephone Company. Capital stock, $1,000. Incorporators, William R. Jackson, Edwin Packwood, F. M. Vance, E. Ross.

LINDEN—People's Co-operative Telephone Company. Capital stock, $1,500. Directors, Thomas Wilkins, Levi Martin, Garrett D. Snyder, Daniel Harrigan, John M. Parker, George L. White, Jesse W. Gobin.

FULTON—Fulton Telephone Company. Capital stock, $5,000. Directors, William Troutman, E. E. Jackson, Charles L. Becker, Reuben Hendrickson.

ELIZABETH—Harrison County Telephone Company. Capital stock, $10,000. Directors, Michael J. Bower, Robert E. Williams, Clarence E. Kron.

CAMDEN—Camden Co-operative Telephone Company. Capital stock, $4,000. Incorporators, U. E. Tesh, C. E. Baker, Fred G. Arnick, J. S. Plank, O. W. Wyatt.

SUMMITVILLE—Farmers' Rural Telephone Company. Capital stock, $5,000. Incorporators, John F. P. Thurston, George W. Webster, John H. Brown, L. P. Brown, John R. Allen, Francis M. Jones, Walter Potts, Wallace Poindexter.

LAWRENCE—Lawrence Telephone Company. Capital stock, $10,000. Directors, M. M. Hindman; H. L. Rattliff, Harry Mullenkopf.

CENTERPOINT—Centerpoint Telephone Company. Capital stock, $5,000. Incorporators, H. F. Webber, P. L. Lansitt and others.

CYNTHIANA—Cynthiana Telephone Company. Capital stock, $3,000. Incorporators, George Cannaday, W. J. Heims and others.

GREENFIELD—Cleveland Telephone Company of Hancock County. Incorporators, E. H. Thomas, I. L. Sample, E. L. Furry and others.

NAPOLEON—Napoleon and Newpoint Telephone Company, organized. President, Stephen Vankirk; secretary, Frank Vankirk; treasurer, Pink Harbert; directors, F. J. Crow, Henry Norwald, Geoge Holzhausen.

HAZLETON—Hazleton Telephone Company. Capital stock, $2,000. Directors, W. C. McFetridge, T. N. Davidson, W. A. Barnett, H. M. Arthur, C. F. Stearns, W. W. Spain.

MOHAWK—Northwestern Long Distance Telephone Company. Capital stock, $2,000. Incorporators, J. W. Murphy, Sr., and others.

IOWA.

DUNCOMBE—The Duncombe Telephone Company has been organized. Capital stock, $10,000. President, D. Maricle; vice-president, Fred Folger; secretary, Dr. J. Thompson; treasurer, J. J. Claussen.

ELBERON—Farmers' Mutual Exchange Association, organized. President, E. P. Skrable; vice-president, Geo. H. Theissen; treasurer, N. K. Shugart.

OXFORD—The Eastern Iowa Telephone Company.

FARRAGUT—Farragut Telephone Company. Capital stock, $5,000. President, R. Whistler; vice-president, H. Rogers; secretary, Wm. Rogers; treasurer, Lee Greedy; directors, F. S. Jarman, S. Crosser, A. T. Chambers, Jesse Whisler, E. N. Craft.

FOREST CITY—The Farmers' Co-operative Telephone Company, organized. President, Geo. A. Faber; vice-president and treasurer, R. O. Beaver; secretary, E. M. Awe; directors, H. Beaver, T. Lubben, A. A. Sheldon.

PLYMOUTH—Plymouth Telephone Company. Capital stock, $10,000.

MUSCATINE—Conesville Telephone Company. Capital stock, $10,000. President, J. G. Van Lent; vice-president, J. W. McKee; secretary and treasurer, Hal C. Wolford.

SLOAN—People's Telephone Company. Capital stock, $15,000. President, Wm. Manley; vice-president, F. O. Hendee; secretary, Tom Walpole; treasurer, A. L. Calderhead.

HARTLEY—Hartley and Pringhar Telephone Company of O'Brien County. Capital stock, $2,000. Incorporators, O. F. Mathis, Albert Peterson, W. D. Cory, R. H. Ault, A. P. Besser.

DANVILLE—Danville Mutual Telephone Company. Capital stock, $9,700.

ARLINGTON—Arlington Telephone Company. Capital stock, $5,000. Incorporators, W. L. Sanborn, M. E. Southwick.

CASEY—Casey Mutual Telephone Company.

SANBORN—Flovd Valley Rural Telephone Company. Capital stock, $1,000. Incorporators, N. S. Miller, P. H. Miller, Wm. Clarksen, George Dummett, J. H. Greet, J. J. Getting.

AMUND—Farmers' Co-operative Telephone Company, organized. President, George A. Faber; secretary, E. M. Awe.

KANSAS.

COMISKEY—Farmers' Telephone Company, organized. W. S. Pickenpaugh, president; J. Naff, vice-president; J. J. Wingfield, treasurer; E. P. Grant, secretary.

TESCOTT—Tescott Telephone Company. Capital stock, $3,000.

GLEN ELDER—Blue Hill Telephone Company. Capital stock, $2,500.

ENGLEVALE—Englevale Telephone Company. Capital stock, $2,000.

DE SOTO—De Soto and Olathe Telephone Company. Capital stock, $2,000.

CHASE—Chase Telephone Company. Capital stock, $4,000.

KENTUCKY.

SCOTTSVILLE—The Allen County Telephone Company. Capital stock, $2,500.

EWING—The Ewing and Maylick Telephone Company, organized.

LODIBURG—Lodiburg and Webster Telephone Company, organized. President, James St. Clair; treasurer, Jesse Payne.

BARBOURVILLE—The Hyden Telephone Company has elected the following officers: President, Abner Eversole; vice-president, Judge H. C. Faulkner; secretary and general manager, John Woodward; treasurer, G. A. Lock.

MAINE.

CASCO—Naples Telephone Company. Capital stock, $10,000. J. P. Ficket, Naples, Maine, president and treasurer.

MICHIGAN.

SHERIDAN—The Sheridan Telephone Company has been organized. President, John Meeuwenberg; secretary, Joseph Rozema; treasurer, Garret Dobben.

MIO—The Mio Telephone Company. Capital stock, $2,000.

AMBOY—The Clear Fork Telephone Company organized.

COLDWATER—The Wolverine Telephone Company.

MUNITH—Waterloo Central Telephone Company.

MASON—Mason and Okemos Telephone Company, organized. Capital stock, $500. President, W. O. Wilson; vice-president, Wm. A. Olds; secretary, B. J. Potter; treasurer, H. Guile; trustees, H. D. Strickland, Upton Hammond, James True.

CLAYTON—North Clayton Telephone Company of Lenawee county. Capital stock, $5,000.

MINNESOTA.

PELICAN RAPIDS—Pelican Rapids Telephone Company. Capital stock, $25,000.

COTTONWOOD—Home Telephone Company. Capital stock, $10,000.

ROTHSAY—The Rothsay Telephone Company.

ZUMBRO FALLS—Zumbro Falls Telephone Company, organized. President, Chas. F. Anding; vice-president, J. J. Springer; secretary, A. H. Sugg; treasurer, A. Robertson.

RENVILLE—Renville Telephone Company. Capital stock, $20,000. Incorporators, A. E. Carver, A. E. Rieke, S. W. Smith, Paul Albrecht, C. W. Parsons, Fairfax; O. W. Harris and R. E. O'Keefe, Franklin.

BATH—Tri-County Farmers' Telephone Company Association, organized. Capital stock, $21,000. Directors, R. J. Dobell, M. L. Head, S. Newgard, E. M. Thompson, M. H. Sheenan, E. O. Nervis, C. C. Campbell, N. J. Dunnighan, Rev. J. J. Strand.

ELLENDALE—Farmers' Mutual Telephone Company, organized.

RIDGEWAY—Cedar Valley and Ridgeway Telephone Company, organized.

BETHEL—Potato Belt Telephone Company. Capital stock, $20,000. Incorporators, Charles E. Burch, Minneapolis; Roland J. Dyer, Elmer E. Davis, George I. Sylvester, Samuel F. Cooper, Marcia A. Mitchell, Bethel.

HANSKA—Hanska Rural Telephone Company. Capital stock, $50,000. Incorporators, D. F. Wood, George Chambard, C. I. Stone and others.

MISSOURI.

MEMPHIS—The Scotland County Telephone Company. Incorporators, C. M. Moore, W. D. Short, H. G. Merritte and others. Capital stock, $10,000.

BLACKBURN—Blackburn Telephone Company. Capital stock, $5,000. Incorporators, W. T. Litten, Martin Seipp, M. E. Brady and others.

CONWAY—Conway Rural Telephone Company. Capital stock, $10,000.

CLARKSDALE—Clarksdale Telephone Company. Capital stock, $2,500.

CHARLESTON—Southeast Telephone Company. Capital stock, $150.000. Incorporators, J. Handy Moore, Paul B. Moore, Mary Moore, J. E. Armstrong and R. B. Boyce.

DEKALB—De Kalb Telephone Company. Capital stock, $10,000. Directors, George F. Davis, William P. Allison, John W. Buis, Walter W. Head, Charles W. Davis.

MONTANA.

OVANDO—Big Blackfoot Telephone Company.

NEBRASKA.

OCTAVIA—The Octavia Telephone Company organized. Capital stock, $3,000. E. A. Rusher, president; Morris Keller, secretary; A. F. Eberly, treasurer.

ELBA—Howard County Telephone Company. Capital stock, $25,000. President, F. M. Brass; vice-president, M. A. Fugate; secretary, Peter Jepson; treasurer, C. C. Hansen; general manager, P. G. Frandsen.

FARWELL—Farwell Telephone Company. Capital stock, $10,000. President, J. P. Mikkleson; secretary and treasurer, Mike Lorkowski.

ALEXANDRIA—Farmers' Telephone Company. Capital stock, $5,000.

ENDICOTT—Endicott Telephone Company. Capital stock, $2,500. Incorporator, H. Stolz.

WAKEFIELD—Northwestern Telephone Company. Capital stock, $100,000.

ELM CREEK — Fairview Telephone Company. Capital stock $5,000.

BIG SPRING—Lewellen-Big Spring Telephone Company. Capital stock, $10,000. Incorporators, G. B. Orr, John H. Orr, A. Meeker, M. C. Remington, Henry Block, Henry Tilgner.

NEW JERSEY.

HAMILTON—The Pleasant Valley Telephone Company. Capital stock, $5,000. Incorporators, Chauncey S. Munson, Frank Sherman, Norval E. Reed.

PASSAIC—The New York Automatic Telephone Company. Capital stock, $1.000. Incorporators, Charles R. Newman, George Roegner, Adolph C. Gilgen.

PENNINGTON—Pennington Telephone Company. Capital stock, $5,000. Incorporators, W. H. Bogert, J. J. Crowerly, Joseph F. Harris.

NEW YORK.

NEW YORK—The Switchboard Manufacturing Company, New York. Capital stock, $15,000. Incorporators, William B. Maloney, Louis Freund, Ernest Onnell.

SCOTCHTOWN—The Scotchtown Telephone Company. Capital stock, $2,000. Incorporators, Milton H. Santee, Herbert Mills and S. Wickham Rockfellow.

NARROWSBURG—The Big Eddy Telephone Company. Capital stock, $8,000. Incorporators, G. W. Englemann, John Hessburg, D. W. Longstreet.

OSSINING—Telephone Appliance Company. Capital stock, $12,000. Directors, S. S. Newton and Hermon Meyer, New York city; S. J. Cox, Cranford, N. J.

JACKSONVILLE—Ulysses Co-operative Telephone Company. Capital stock, $7,000. Incorporators, Walter Mekeel, A. H. Wood, F. A. Miller.

PLEASANT VALLEY—Pleasant Valley Telephone Company. Directors, C. Frank Foster and L. W. Knapp of Earlville; George W. Berry of Poolville; C. S. Munson, East Hamilton; H. C. Williams and S. A. Fitch of Hamilton.

NORTH DAKOTA.

FULLERTON—Fullerton and Roseburd Telephone Company organized. President, E. S. Thomas; F. O. Alin, secretary.

RENVILLE—Renville Rural Telephone Company. Capital stock, $20,000. Chief incorporator, A. E. Carver.

FAIRMOUNT—Farmers Telephone Company. Capital stock $6,000.

OHIO.

TROTWOOD—The Trotwood Telephone Company. Capital stock, $10,000. Incorporators, G. W. Minnick, William Swinger, Joseph Lambs, S. A. Blessing, W. L. Bashor.

GIBSONBURG—The Seneca Telephone Company. Capital stock, $20,000. Incorporators, N. B. Erwin, F. C. Hornung, F. W. Zorn, A. H. Miller, C. B. Snyder.

LAMARTINE—Dining Fork Telephone Company. Capital stock, $10,000. Incorporators, W. McLandsborough, J. McLandsborough, S. McLandsborough, E. H. Kennedy, J. Harrison.

WEST ALEXANDRIA—Preble County Telephone Company. Capital stock, $25,000. Incorporators, J. C. Stover, J. E. Flora, A. M. Fudge, J. J. Burtner, J. S. Steward, W. N. Brubaker.

BRUNSWICK—Brunswick Independent Telephone Company. Capital stock, $5,000. Incorporators, Dennis M. Johnson and others.

CENTERBURG—Central Ohio Telephone Company. Incorporators, T. P. Sylvan, E. E. McGuire, C. L. Bishop, J. E. Litzenberg, G. N. Jackson. Capital stock, $10,000.

TOLEDO—Central Telephone Construction Company.

OREGON.

JUNCTION CITY—The Farmers' and Merchants' Telephone Company organized. President, J. S. Brubaker; vice-president, J. H. Miller; secretary-treasurer, J. H. Hill; directors, J. S. Brubaker, J. H. Miller, C. P. Houston, J. N. Dennis, J. H. Hill.

CROW—Crow Telephone Company. Capital stock, $1,000. Incorporators, Charles Hadley, Herman Bjerke, Joseph Hooker, William Mathers.

PENNSYLVANIA.

ROYALTON—Wyoming and Sullivan County Telephone Company. Capital stock, $5,000.

MARTINTOWN—Farmers' Union Telephone Company. Capital stock $5,000. Treasurer, John J. Williams, Martintown; directors, Jacob R. Lute, G. M. Joiner, C. E. Hallen, D. W. Kerlinskey, Ebby Smith, Richard Williams, A. G. Glenn, Wm. Glenn, Scott Smith, Emanuel Keith, Frank Long, J. H. Lute, Alfred Oaks.

SOUTH CAROLINA.

GRANITEVILLE—Graniteville Telephone Company. Capital stock, $2,500. President and treasurer, W. A. Giles; secretary, C. B. Willis.

SOUTH DAKOTA.

BUFFALO GAP—The Cheyenne River Telephone Company. Capital stock, $10,000.

REDFIELD—Redfield Telephone Company. Capital stock, $50,000.

BUFFALO GAP—W. G. Flat Telephone Company. Capital stock, $600.

UTAH.

ST. GEORGE—Southern Utah Telephone Company. Directors, Robert C. Lund, James Andrus, Edward H. Snow, Charles S. Wilkinson, B. J. Lund.

VIRGINIA.

BROADFORD—The Broadford Telephone Company. Capital stock, $5,000. President, L. H. De Forest.

WISCONSIN.

MONDOVI—The Mondovi Telephone Company. Capital stock of $240,000. Incorporators, B. S. Lockwood, George A. Leutscher, S. D. Hubbard, C. W. Gilman.

BROWNTOWN—The Cadiz Telephone Company has been organized. The officers are as follows: Ed. L. Divan, president; A. J. Spece, vice-president; C. K. Allen, secretary; W. Bush, treasurer; J. H. Bash, Herman Keil, Ed Nelson, directors.

IOLA—Iola Telephone Company. Capital stock, $5,000. Incorporators, N. H. Johnson, F. W. Black, S. M. Myhre.

ROBERTS—Roberts Telephone Company. Capital stock, $5,000. Incorporators, A. Turner, Sr., David Imri, R. C. Andrus, George T. Turner and A. J. Walker.

EAU GALLE—Eau Galle Telephone Company. Capital stock, $5,000. Incorporators, C. G. Billings, William Stoops, F. H. Thines.

SOUTH WAYNE—Crosby and Blaisdell Telephone Company. Capital stock $25,000. Incorporators, A. N. Crosby, W. C. Blaisdell, W. R. Bixby.

MINERAL POINT—Willow Springs Telephone Company.

ANNUAL MEETINGS.

CALIFORNIA.

SARATOGA—The Saratoga Mutual Telephone Company has elected the following officers: President, Ralph A. Husted; secretary, James P. Richards; treasurer, Dr. R. L. Hogg; directors, J. M. Lipscomb, W. B. Tomlinson.

COLORADO.

DELTA—The Co-operative Telephone Company has elected the following officers: President, P. R. Rockwell; vice-president, W. J. Hunt; secretary and treasurer, Dr. Follensbee.

ILLINOIS.

HANNA CITY—The Cherry Fork Telephone company has elected the following officers for the ensuing year: H. B. Pinkerton, president; Dan Larkin, vice-president; W. W. Gardner, secretary; Wm. Glasgow, treasurer.

LAFAYETTE—The Lafayette and Center Prairie Telephone Company has elected officers as follows: Hymen DeWolf, president; Henry Bradley, vice-president; Fred Atherton, secretary and treasurer.

PEARL CITY—The Farmers' Mutual Telephone Company, organized. President, L. C. Hollister; vice-president, T. O. Musser; secretary, W. W. Buckley; treasurer, G. W. Dow; directors, Samuel Ditzler, Ed Tollmeier, L. C. Housell, Smith Geddings, W. N. Flickinger, A. K. Eby.

PIASA—The Mutual Telephone Company has elected the following officers for the ensuing year: President, G. R. Waggoner; vice-president, James Longwill; secretary, G. H. Clark; treasurer, Abner Stratton.

WARREN—The Lafayette and Jo Davies Telephone Company has elected the following officers: President, Henry Balbac; vice-president, Louis Cullen; secretary, H. J. Winans; treasurer, Barthol Gille; managers, Albert Neff, Moses Dersham, J. A. Buser.

INDIANA.

FT. WAYNE—The National Telephone and Telegraph Company has elected the following officers: Henry C. Paul, president; C. S. Bash, vice-president; W. J. Moellering, secretary and general manager; W. A. Bohn, treasurer.

WINCHESTER—The Winchester Telephone Company has elected the following officers: President, A. L. Nichols; treasurer, P. E. Goodrich; secretary, J. A. Brown.

IOWA.

DUBUQUE—The Interstate Telephone Company has elected the following officers for the ensuing year: V. H. Stevens, president; R. W. Gadson, vice-president; C. M. Laxson, secretary and treasurer. Directors, J. H. Denkhoff, J. M. Dunn, J. J. Kam.

FARMERSBURG—The Wagner Telephone Company has elected the following officers for the ensuing year: John Shrader, president; Henry Henks, vice-president; A. A. Kishman, secretary; William Kath, treasurer; Wm. Heber, Louis Saurche, Eli Shepperd, directors.

RED OAK—The Montgomery Telephone Company has elected the following officers: President, S. G Hersman; vice-president, C. H. Brown; treasurer, C. F. Clark; manager and secretary, J. F. Miller.

MECHANICSVILLE—The Mechanicsville Telephone Company has elected the following officers for the ensuing year: President, Alex. Buchanan; secretary, F. L. Wilson; treasurer, E. Webbles.

ESSEX—The City Telephone Company has elected the following officers: President, C. J. Johnson; vice-president, John Haglund; secretary, F. O. Peterson.

INDEPENDENCE—The Buchanan County Telephone Company has

elected the following officers: President, Dr. Herr; secretary, A. D. Mount; treasurer, John Robinson; director, D. Peck.

CEDAR FALLS—The Cedar Falls Mutual Telephone Company has elected the following officers and directors: President, N. H. Harris; vice-president, Dr. Brodie; secretary, F. O. Jackson; treasurer, O. H. Leonard; Roger Leavitt, L. O. Robinson, W. N. Hostrop.

KANSAS.

DOVER—The Dover Rural Telephone Company has elected the following officers for the ensuing year: President, J. W. Sage; secretary, E. L. Knapp; treasurer, Albert Kimble.

MASSACHUSETTS.

FALL RIVER—The Fall River Automatic Telephone Company has elected the following officers for the ensuing year: B. D. Davol, clerk and treasurer; E. B. Jennings, Wm. J. Dunn, R. J. Thompson, R. F. Haffenroffer Jr., P. A. Mathewson, M. Sweeney, Quinlan Leary, Vinton A. Sears, Martin Feeney, R. P. Borden.

MICHIGAN.

AITKIN—The Aitkin Grand Rapids Telephone Company has elected the following officers: President, H. Chute; vice-president, C. C. Sutton; secretary, C. D. Chute; treasurer, Carl S. Anderson; L. G. Seavey and John A. Harris, trustees.

KIBBIE—The Kibbie Telephone Company has elected the following officers: S. M. Trowbridge, president; Robert Adkins, vice-president; J. H. Trip, secretary and treasurer.

SPRINGPORT—The Springport Mutual Telephone Company has elected the following officers: President, Andy Courtwright; secretary, Oscar Baker; treasurer, L. Carter; manager, Will Cooper.

PARMA—The North Parma Telephone Company has elected the following officers for the ensuing year: President, Jas. A. Dean; secretary, B. L. Hubert; treasurer, S. H. Godfrey; directors, James A. Dean, Arthur Landon, S. N. Godfrey, Frank Brown, B. L. Hubert.

MINNESOTA.

KERKHOVEN—The Mamre and Pillsbury Telephone Company has elected the following officers: Alfred Hohngren, president; J. W. Johnson, vice-president; P. S. Ekberg, secretary; H. C. Odnay, treasurer.

LE SUEUR—The Farmers' and Merchants' Telephone Company has elected the following officers: President, H. Weckworth; vice-president, F. A. Dodge. Improvements and extensions will be made.

MISSOURI.

MOBERLY—The Cairo Telephone Company has elected the following officers: President, Harry McKinney; vice-president, F. Haines; secretary, John Boucher; treasurer, J. W. Stigall.

HANNIBAL—The Miller Township and Hannibal Telephone Company has elected the following directors for the ensuing year: L. E. Frazer, H. Clay Whaley, L. C. Hendren, Judge Geo. W. Pine, John A. Miller.

NEW HAMPSHIRE.

DUNBARTON—The Dunbarton Telephone Company has elected the following officers: Edward P. Page, president; James E. Stone, vice-president; F. L. Ireland, secretary; Henry S. Whipple, treasurer; John Bunton, manager.

NEW YORK.

SANBORN—The Sanborn and Schance Telephone Company has elected the following officers: S. A. Crosby, president; Walter Baer, secretary and treasurer; Ed Crosby, superintendent.

WARSAW—The Wyoming County Telephone Company has elected the following officers: President, Henry A. Pierce; vice-president, N. H. Lewis; secretary, E. B. Windsor; treasurer, M. N. Cole.

ITHACA—The Ithaca Telephone Company has elected the following officers: President, B. G. Hubbell; vice-president, M. Van Cleef; treasurer, H. L. Hinckley; secretary, Charles H. Blood.

NORTH DAKOTA.

BUXTON—The Red River Valley Telephone Company has elected the following officers and directors: T. J. Smith, Reynolds, president; S. H. Hagen, Northwood, secretary and treasurer; S. K. Knutson, Bellmont; Theo. Kaldor, Hillsboro; O. A. Hong, Buxton; W. H. Robinson, Mayville; P. M. Paulson, Portland; M. F. Hegge, Hatton; Iver Thompson, Portland.

OHIO.

VAN WERT—The Home Telephone Company at its annual meeting elected the following officers for the ensuing year: James Poling, president; H. B. Stemen, vice-president; George Snyder, secretary; Perry Kohn, treasurer.

WAYNESFIELD—The Auglaize Telephone Company has elected the following officers for the ensuing year: President, Harper Stiles; vice-president, R. T. Means; treasurer, Dr. Turner; secretary, Jesse Bowdle.

CRESTLINE—The Crestline Telephone Company has elected the following officers: President, J. Bapst; vice-president and general manager, C. R. Callaghan; secretary, F. A. Knapp.

PENNSYLVANIA.

EVERETT—The Bedford-Fulton Telephone Company has elected the following directors: W. H. Baumgardner, Wells' Tannery; Dr. R. B. Campbell, New Grenada; John Q. Nycum, Ray's Hill; E. N. Palmer, Dr. H. W. Bender, John H. Hershberger, Thomas A. Jones, W. W. McDaniel, C. G. Masters, Everett.

SOUTH DAKOTA.

CANTON—The Canton Telephone Company has elected the following officers for the ensuing year: President, C. B. Kennedy; secretary, D S. Waldo; directors, Thos. Thorson, C. B. Kennedy, H. N. Cooper, John Anderson, Arthur Linn.

FLANDREAU—The Flandreau Telephone Company has elected the following officers: President, J. E. Peart; vice-president, F. J. Mead; secretary, W. A. Simpson; treasurer, Geo. H. Few.

TENNESSEE.

CLARKSVILLE—The Home Telephone Company has elected the following officers: H. C. Merritt, president; B. F. Gill, vice-president; Dancy Fort, secretary-treasurer.

VERMONT.

ST. JOHNSBURY—The Citizens' Telephone Company has elected G. W. Buzzell, president and treasurer; Harland B. Howe, secretary; W. H. Furban, director.

RANDOLPH—The Randolph Telephone Company has elected the following officers: H. W. McIntyre, president; Dr. H. H. McIntyre, secretary and treasurer.

CHELSEA—The Orange County Telephone Company has elected the following officers and directors: C. L. Spears, president; George Crane, vice-president; R. H. Williams, secretary and treasurer; C. S. Emery, auditor; E. H. Kennedy, H. L. Towne, M. W. Chamberlain, Henry Waldo, Myron W. Daly.

VIRGINIA.

MIDDLEBROOK—The Middlebrook Telephone Company has elected the following directors: J. H. Bowman, Richard Hogshead, W. B. Glora, C. R. Caldwell, W. C. Bossermann, J. E. Cae, T. M. Smiley, J. Frank Clemer.

SMITHFIELD—The Home Telephone Company has elected the following officers for the ensuing year: Joseph W. Holloway, president; Benjamin P. Gay, general manager; A. S. Barrett, secretary and treasurer. P. D. Gwaltney, Jr., F. R. Berryman, V. W. Joyner, Captain George A. Savage, C. W. Warren, directors.

WISCONSIN.

CHETEK—At a special meeting of the common council a franchise was granted to the Dunn County Telephone Company for the term of fifteen years. Headquarters of the company, Ridgeland.

FOOTVILLE—The Footville Telephone Company has elected the following officers: President, S. W. Lacey; vice-president, W. H. Cory; treasurer, A. E. Aspinwall; secretary, W. O. Howell.

When the Home Telephone Company of Kansas City, Mo., began the construction of its system it deposited with the city treasurer the sum of $40,000 as a guaranty that it would build and operate a telephone system in accordance with the terms of its franchise. City Engineer Pike and City Electrician Holdeman recently inspected the plant of the company and reported that the terms of the franchise had been complied with, whereupon the board of public works issued an order to the city treasurer to refund to the company the $40,000 it deposited as a guaranty.

The Dakota Central Telephone Company of Aberdeen, S. D., has secured control of the lines in the central and southern part of the state and in Minnesota, formerly owned by auxiliaries of the Western Electric Telephone Company. The management of the Dakota Central consists of 1,023 miles of pole lines, giving the Aberdeen company something over 4,000 miles of pole line altogether, and covering the entire state of South Dakota except the extreme southeastern portion. The expenditure for the acquirement of the two systems and the improvements is between $275,000 and $300,000.